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Index.

[For Index of Register of Patents, Correspondence, and Parliamentary and Legal Intelligence, see pp. ix. and x.]

Aberdare and Aberaman Gas Company, 496, 604
Aberdeen Gas Undertaking, 49
Aberfeldy Gas Supply, 365
Abertillery Water Undertaking, 106
Accidents—
  And the Curtailment of Street Lighting, 269
  At Gas Works, 336, 400, 450, 506, 662, 718, 723
  At the Midland Railway Works, 715
  Litigation Respecting, 327
Accrington Plumbers and Municipal Work, 609
Acetylene Gas Generation Apparatus, 181
Acts, Gas and Water, 268
Adams's, Mr. H. C., Presidential Address to the Institution of Municipal Engineers, 503, 596
Air Compressors, Filters for, 257
Albany Municipal Gas Undertaking, 662
Aldershot Electric Power Station Nuisance, 443
Aldershot Gas, Water, and District Lighting Company, 158, 365
Allen's, Mr. E., Posthumous Contribution to the International Gas Congress, 76, 79
Alliance and Dublin Consumers' Gas Company—
  Correspondence, 145, 206
  Editorial Comments, 15
  Illegally Lighting Lamps, 221
  Meeting of Shareholders, 44
  Quality of the Gas, 330, 445
  Staff and the War, 15
  Wages Increase, 220
America—
  Benzol Output by Bye Product Coke Ovens in, 494
  Bye Product Coking in, 438
  Coke Production in, 638
  Dye Stuff Industry in, 658
  Minimum Rate Electricity Supply in, 662
  Natural Gas in, in 1914, 257, 447, 483
  Road Opening Methods in, 553
  Standardization of the Quality of the Gas Supplies in, 475
American Bureau of Standards Circular (No. 32), 475
American Commercial Gas Association (*see* National)
American Gas Institute (*see also* International Gas Congress)—
  Presidential Address of Mr. E. C. Jones, 90
  Review of the Proceedings, 194, 255
American Institute of Electrical Engineers, 244
Ammonia Recovery from Waste Liquor, 704
Ammoniacal Liquor Storage, 419, 424, 495
Ammoniæ, Liquor, Direct Production of, from Gas Liquor, 436
Amsterdam Municipal Gas Undertaking, 501, 634
Anglo Romano Gas Company, 160
Arbitrations—
  Barnsley Gas Workers, 662
  Cheltenham Gas Workers, 330, 393
  Coatbridge Gas Workers, 214
  Metropolitan Water Board (Hertford Sewage Works), 372
rbitrators, Institute of, 587
rchitects and the Service of Gas, 303
rdwick Water Supply, 554
rgentina, British Trade and, 474
shton-under-Lyne Gas Company, 337
ssault Charge against a Gas Worker, 548
ssen Gas Undertaking, 128
ssessment Questions—
  Aberdeen Gas Works, 49
  Brompton and Kensington Electric Supply Company, 443
  Dundalk Gas Works, 147
  Glasgow Private Lights, 549
  Metropolitan Water Board—
    Chertsey Water Intake, 601
    Walton Pumping Station, 327
  Motherwell Gas Works, 49
  Truro Gas Works, 53, 451
  Water Rates at Woking, 651
  Westgate and Birchington Gas Works, 157
storia Tunnel (New York) for Gas Mains, 241, 251, 316
thens, Lighting of, 722
thy Public Lighting, 54, 103, 335
ustralia, Underground Waters in, 704
yr Gas Undertaking, 155

adges for Gas Works Employees, 15, 336
adische Anilin und Soda-Fabrik's Process of Separating Water Gas, 534
agshot Public Lighting, 49
Baking Biscuits by Gas, 426
Banwell Gas Company, 157
Barker, Professor A. H., on Electric Heating, 630, 710
Barnsley Gas Company, 604, 662
Barometers, Mounting and Illumination of, 428
Barrow-in Furness Gas and Water Supply, 160, 452, 608
Barry, Demand for Coke at, 506
Basingstoke Gas Company, 182
Bedford Gas Company, 181
Beighton and District Gas Company, 496
Belfast Electricity Undertaking, 55
Belfast Public Lighting, 553
Beil's, Mr. J. F., Paper to the International Gas Congress, 43
Benzol—
  Determination of, in Gas, 264
  Explosion at Beckton Gas Works, 159, 212, 265
  German Supplies of, 197, 607
  Output of, by Bye Product Coke Ovens in America, 494
  Recovery—
    And Naphthalene Troubles, 575, 581, 598
    In Gas Works, 549, 605, 697, 711
    Rittmann Process, 482
  Synthetic Phenol from, 587
  Taylor, Mr. G., on, 639
Berlin City Gas Works and the Supply of Coke, 132
Berlin Gas Works Operating Company, 653
Bexhill Water and Gas Company, 52
Bills, Gas and Water, 268, 444, 471, 496, 712
Bilston Gas Company, 718
Bingley Gas Undertaking, 723
Birkenhead Gas Undertaking, 272
Birkenhead Municipal Undertakings, 47
Birmingham—
  Boulton and Watt Collection at, 281
  Failure of Electric Current at, 157
  Meter Testing Department, 609
  Municipal Work in, 363
  Proposed Labour Board at, 336
  Schools and Light Economy, 401
Birmingham Business Club, 656
Birmingham Electricity Undertaking, 396
Birmingham Gas Undertaking—
  Accident at Windsor Street Works, 723
  Appeal for Economy by Gas Consumers, 213, 472, 499
  Chairmanship, 398
  Contract and Stores Committee, 213
  Editorial Comments, 472
  Extensions at Nechells, 152
  Labour Supply, 104, 396
  Presentation to Dr. W. B. Davidson, 305
Birmingham Water Undertaking, 160, 396, 398, 553
Biscuit Baking by Gas, 426
Bishop's Stortford, Harlow, and Epping Gas and Electricity Company, 182
Blackburn and Griffith, Messrs., on the Definition of "Domestic Purposes" in Water Acts, 645 (*See also* Vol. cxxxiii.)
Blackburn Gas Department, 153, 156
Board of Trade—
  Advice to Coal Consumers, 538
  British Trade Exhibition, 697
  Chemical Intelligence Department, 302, 308
  Coal and Coke Export Returns, 127, 422, 631, 642
  Enlistment Restrictions Department, 369
  Provisional Orders for 1916, 320
Boilers—
  Coke for (*see* Coke)
  Electric, 245
  Gas, Determining the Efficiency of, 260
Bolton Water Undertaking, 209
Bone, Professor W. A., on—
  Fuel Economy, 447, 450
  Government Scheme for the Organization and Development of Scientific and Industrial Research, 303, 323, 359
  Value from Waste, 76
Books Received—
  British Coal Trade (H. S. Jevons), 320
  Calculating the Diameters of Mains, &c. (G. H. Elliott), 531
  Coal Distillation and Bye Products (J. E. Christopher), 16, 183
  Fuel Problem (London Coke Committee), 594
  Gas Turbine, The (Norman Davey), 636
  Gas Works Directory and Statistics (Hazell, Watson, and Viney), 597
  High Power Gas Engines (H. Dubbel), 535
Books Received (*continued*)—
  Mechanical World Electrical Pocket Book, 725
  Mechanical World Pocket Diary, 578
  Memoirs of James Robson, 244
  Painting by Immersion and by Compressed Air (A. S. Jennings), 243
  Salesman's Handbook (National Commercial Gas Association), 543
  Work of the Institution of Gas Engineers (C. W. Hastings), 535
Boulton and Watt Collection at Birmingham, 281
Bradford Electricity Undertaking, 477
Bradford Gas Undertaking, 281, 389, 609, 725
Bradford Public Lighting, 104
Bradford Water Supply, 219, 609
Bradford-on-Avon Gas Undertaking, 529
Branson's, Mr. A. W., Presidential Address to the Wales and Monmouthshire Institution, 36
Brender à Brandis, Heer, on Gas from Peat, 94
Bridgwater Gas Company, 100, 400
Brigg Gas Supply, 208, 450
Brighouse Gas Undertaking, 283
Brighton and Hove Gas Company, 15, 83
Brighton Electricity Undertaking and Artizans Dwellings, 579
Brighton (Victoria) Gas Company, 52
Brisbane, Price of Gas at, 723
Bristol Gas Company, 500
Bristol Water Company, 477, 578
British Association—
  Address by Professor W. A. Bone, 76
  Fuel Economy Committee, 124, 128
  Smoke Prevention Discussion, 84
British Bontempi Rust-Proofing Company, 708
British Coalite Company, 713, 655
British Commercial Gas Association—
  Annual Meeting, 188
  Calendar for 1916, 443
  Editorial Comments, 177
  Edwards, Mr. R. W., on the, 185
  Gas Industry and Capital Restrictions, 265, 302
  Industrial Fuel Committee, 632
  Literature, 578
  Naphthalene Stoppages and Benzol and Toluol Extraction, 598
  Notes on the Proceedings, 188
  Presidential Address of Bailie Paxton, 189
  Report and Accounts, 190
British Dyes Limited, 221, 268, 423
British Gaslight Company, 45
British Trade—
  Exhibition, 697
  Opening for, in Holland, 362, 388
  The War on, 310
British Westinghouse Company's Engines, 482
Brompton Electric Supply Company, 443
Brooks, Mr. B. W., on the Application of Gas to Industrial Purposes, 474, 484
Brown, Dr. R. K., on Heating and Health, 104
Bruges Gas Supply, 51
Bruhn, Herr K., on Naphthalene as a Fuel, 644
Budapest Gas Works Conveying Plant, 78, 86
Budleigh Salterton Public Lighting, 723
Buenos Ayres Water Works Company, 552
"Builder" on Gas Fires, 15, 48
Burnden Tar Company, 548
Burners, Wallwin and Sinnatt's, 315
Burnley Water Supply, 54, 158, 496
Burslem Gas Undertaking, 505
Burton Gas Undertaking, 398, 552, 607
Bury Public Lighting, 54
Bye Product and Coking Plant at Tinsley Park Colliery, 437
Bye Products—
  And Products of Coal, 135
  Coal Distillation and, 16
  Coking and Chemistry, 321
  Coking in the United States, 438
  Industry, 48, 369, 527, 539

Calendars, &c., for 1916, 443, 724
Calico Printers' Association and the Dye Question, 78
California University, Gas Engineering at, 92
Calorific Value—
  America and, 475
  And Calorific Standards, 13, 34
  Canada and, 180, 242, 495
  Incandescent Gas Lighting and, 145
  Pierce, Mr. R. ff., on, 145
  "Times" Engineering Supplement on, 242
  Tipton Urban District Council and, 278

346314

- Camberwell Borough Council Surcharged for War Bonus Payments, 601
- Campbeltown Gas Undertaking, 529
- Canada—
  - Calorific Standard in, 180, 242, 495
  - Gas and Meter Testing in, 217
- Canadian Department of Mines Bulletin, 135
- Canadian Gas Association, 217
- Candle Power per Ton of Coal, 473
- Capital Raising by Gas Undertakings during the War, 265, 302, 451, 552, 712
- Carbonization (*see also* Chamber Ovens *and* Retorts)—
  - Christopher, Mr. J. E., on, 16, 183
  - Low Temperature—
    - Del Monte Process, 716
    - Parr and Olin, Messrs., on, 307
    - Rollason's Process, 85
  - Thermal Study of the Process of, 24
- Cardiff Electricity Undertaking, 506
- Cardiff Gas Company, 220, 506
- Carlisle Gas Undertaking, 653
- Carmarthen Electric Light Company, 634
- Carpenter's, Mr. Charles, Message to South Metropolitan Co-Partners, 713
- Carpenter, Mr. H., on the Astoria Tunnel (New York), 251, 316
- Carrickmacross, Lighting of, 104
- Carter and Stansfield, Messrs., on Products and Bye Products of Coal, 135
- Case Hardening by Gas, 305, 312
- Catalogues, Booklets, &c., 55, 106, 160, 212, 284, 449
- Ceará Gas Company, 220, 277
- Cement—
  - Certificates for Export, 311
  - Portland, 197
- Chains and other Lifting Appliances, 704
- Chamber Ovens at—
  - Darwen, 547
  - Maestricht, 588
- Chambers, Mr. E. V., on Tar Dehydration, 241, 261
- Chandler's, Mr. S. B., Presidential Address to the London and Southern Junior Gas Association, 179, 198
- Charging and Discharging Machinery, The De Brouwer, 480, 536, 585
- Cheltenham Gas Company, 214, 330, 393
- Chemical Engineering Company's Specialities, 435
- Chemical Intelligence Department of the Board of Trade, A Suggested, 302, 308
- Chemical Society, 24
- Chemistry, Bye Product Coking and, 321
- Chertsey Gas Company, 548
- Chertsey Water Works Intake Assessment, 601
- Chester Gas Company, 104
- Chesterfield Gas and Water Board, 607, 663
- Chrisp's, Mr. G., Presidential Address to the Coke Oven Managers' Association, 369, 527, 539
- Christopher, Mr. J. E., on Coal Distillation and Bye Products, 16, 183
- Circular of Inquiry Nuisance, 362, 527, 598, 632, 656
- Cirencester Gas Company, 51
- City and Guilds of London Examinations—
  - Gas Engineering and Gas Supply, 657
  - Gas Fitting, 427, 657
  - Report for 1915 Session, 636
- City of London—
  - Chief Gas Examinership, 244, 325, 529
  - Death of the Chief Gas Examiner (Professor V. B. Lewes), 181, 243, 324
- Clay Cross Gas Company, 54, 450
- Cleary, Mr. J., on Electricity for Artizans' Dwellings, 579
- Cleckheaton Gas Undertaking, 55
- Clerk, Mr. Dugald—
  - On English and German Methods, 429
  - Thomas Hawksley Lecture, 320
- Clitheroe Gas Undertaking, 337
- Clydebank Public Lighting, 279
- Coal—
  - Carbonization of (*see* Carbonization)
  - Composition of, 137
  - Conservation, 76, 124, 447, 450
  - Distillation and Bye Products, 16, 183
  - Dutch Bureau of, 716
  - Economy Hints, 105
  - Exports—
    - Committee, 337
    - Restrictions, 131, 242, 268, 311, 422, 631, 642
    - Statistics of, 127, 422
    - To Holland, 127
  - Freight Charges on, 471, 528
  - Gas *versus*, for Domestic Purposes, 576, 590
  - Prices—
    - Comments, 421, 422
    - Limitation Act, 13, 43, 78, 239
    - Scottish Gas Undertakings and, 155
  - Products and Bye Products of, 135
  - Spontaneous Ignition of, 260
  - Supplies during the War—
    - Effect of Enlistment on, 538
    - Electricity Undertakings and, 80, 698
  - Trade, British, 320
  - Waggons (*see* Waggons)
  - Winter Supplies of, 179
- Coal Gas and Fuel Industries Department at Leeds University, 148
- Coal Miners—
  - And Enlistment, 327
  - Safety of, 578
  - Wages of, 445
- Coal Owners and Price of Coal Act, 239
- Coalite—
  - Company (*see* British)
  - Death of the Inventor of, 578
- Coatbridge Gas Company, 214, 218, 268, 389
- Cobb and Hollings, Messrs., on a Thermal Study of the Carbonization Process, 24
- Coke—
  - American Production of, 638
  - And Other Matters, by "Qui Vive," 534, 581
  - As Fuel, 594
  - Berlin City Gas Works and the Supply of, 132
  - Contract Litigation, 390
  - Distribution of Cheap, in Holland, 660
  - Export—
    - Committee, 337
    - Restrictions, 23, 131, 268, 311, 631, 642
    - Statistics, 127, 422
  - For—
    - Cooking, 103
    - Electricity Generation, 477
    - Gas Producers, 18
    - Power Production, 656
    - Steam Raising, 451
    - Steam Waggons, 93, 154
  - Fuel Economy and, 440
  - Liability for Damage Caused while Delivering, 389
  - Motor Waggons for Delivering, 32, 33
  - Price Limitation, 488
  - Public Demand for, 506
  - *v.* Electricity for Furnaces, 633
- Coke Oven Gas in—
  - Germany, 15
  - Leeds, 362, 381
  - Middlesbrough, 664
- Coke Oven Managers' Association—
  - Editorial Comments, 419, 527
  - General Business, 369
  - "Iron and Coal Trades Review" on, 244
  - Presidential Address of Mr. G. Chrisp, 539
  - Taylor, Mr. G., on Benzol, 639
- Coking and Bye Product Industry Development in Great Britain, 527, 539
- Coking and Bye Product Plant at the Tinsley Park Colliery, 437
- Coking of Coal at Low Temperatures, 307
- Colchester Gas Company, 444, 496, 552
- Colliery Owners and the Price Limitation Act, 13
- Colne (Lancs.) Gas Undertaking, 182
- Colne Valley Water Company, 725
- Cologne Gas Undertaking, 274
- Colonial Gas Association, 714
- Combustion Heats, Method Employed for Determining, 431, 478, 532, 583, 635
- Commercial Gas Company, 632
- Companies—
  - Enemy, 578
  - New Joint Stock—
    - Carrickmacross Lighting Company, 104
    - Howlett and Co., 331
    - Sanco Gas Mantle Company, 710
    - Stockton-on-Tees Chemical Works, 725
    - Tees Benzol Syndicate, 103
    - United Tube Corporation, 208
- Compensation, Workmen's—
  - Litigation, 159, 327, 390
  - Statistics for 1914, 130
- Concrete—
  - Influence of Temperature on Strength of, 439
  - Reinforced—
    - London County Council Classes on, 130
    - Municipal Works in, 596
- Condensation from Water Gas, 202
- Condenser, Doherty Washer Cooler as a, 141
- Consolidated Gas Company of New York—
  - Astoria Tunnel Works, 241, 251, 316
  - Photographic Records of Meter Indices, 183
- Continental Union Gas Company, 548, 629, 653
- Convention of Royal Burghs, 49, 102
- Conveying Plant at the Budapest Gas Works, 78, 86
- Cooking (*see also* Stoves)—
  - Coke for, 103
  - Electricity for, 530
  - Gas *versus* Coal for, 576, 590
- Co-Partnership—
  - Advantages of, 97
  - Chester Gas Company and, 104
  - Croydon Gas Company and, 337
  - Gas Light and Coke Company and, 608
  - South Metropolitan Gas Company and, 713
- Copper Coinage, Effect of Slot Meters on, 495, 609
- County Councils as Water Authorities, 503
- Coventry, Suspension of the Illuminating Power Test at, 55
- Cowes Gas Undertaking, 15, 47, 609
- Creasey, Mr. H. H., on the Importance of Flues in the Fixing of Gas Fires, 707
- Creosote Prices, 495, 544
- Cromer Gas Company, 83
- Croydon Gas Company, 305, 337
- Curphey, Mr. W. S., on the Storage of Ammoniacal Liquor, 419, 424
- Cyanogen and Sulphur Extraction with Potash Carbonate, 494

- Danish Gas Company, 211, 275
- Darlington Gas Undertaking, 105, 552
- Darwen Gas Undertaking, 396, 547
- Davey, Mr. Norman, on the Gas Turbine, 636
- Davis, Mr. C. G., on Showroom Reform, 242, 246, 324
- Davis Gas Stove Company, 159, 390
- De Brouwer Charging and Discharging Plant, Care and Maintenance of, 480, 536, 585
- Deaths—
  - Andre, K., 632
  - Bennet, Mrs. J., 366
  - Blenkinsop, Lieut. E. W., 83
  - Boyns, C. W., 423
  - Breuer, A., 632
  - Coates, Captain G. H., 700
  - Dann, Lieut. T. V., 181
  - De Brouwer, J., 196
  - Delahaye, A., 364
  - Egglestone, G. T., 181
  - Freeman, R., 83
  - Glover, Captain R. B. G., 364
  - Greiner, A., 477
  - Harrison, R., 181
  - I'Anson, W., 128
  - Jeffery, G. A., 423
  - Kay, J., 181
  - Lewes, Vivian B., 181, 243, 324, 698
  - Light, Jabez, 529
  - Livesey, Lieut. A. G. H., 83
  - Lloyd, R. S., 632
  - Meldola, Raphael, 423
  - Millard, E. H., 15, 47
  - Morris, W., 181
  - Nesbitt, Lieut., 15
  - O'Connor, Lieut.-Colonel Henry, 528
  - Parker, T., 578
  - Roscoe, Sir H. E., 632
  - Rücker, Sir A. W., 323
  - Shearer, G., 333
  - Van der Plank, C. J., 128
  - Walker, Benjamin, 423
  - Welby, Lord, 260
  - Wood, D., 578
- Dejust, M., on Measuring a Venturi Tube Discharge through a Direct Reading Meter, 706
- Del Monte Process, 716
- Denver Union Water Company, 245
- Derby Electricity Undertaking, 245
- Detroit, The Doherty Washer Cooler as a Gas Condenser at, 141
- Devonport Gas Supply, 51
- Dines, Mr. J. S., on Mounting and Illumination of Barometers, 428
- Directory and Statistics of Gas Works, 597
- Dismissal, Action for Wrongful, 653
- Distribution Extensions and Alterations, 143
- Doherty Washer-Cooler as a Gas Condenser, 141
- Doncaster Gas Undertaking, 400, 401
- Doncaster Public Lighting, 102
- Doncaster Tradesmen's Association, 51
- Dorking Gas Company, 53
- Dover Electricity Undertaking, 425
- Dubbel, Mr. H., on High Power Gas Engines, 535
- Dublin Electricity Undertaking, 544
- Dublin Gas Company (*see* Alliance)
- Dudley Gas Works, 718
- Dundalk Electricity Supply, 307
- Dundalk Gas Company, 147
- Dundee Gas Undertaking, 49, 397, 503, 550
- Dunglinson, Mr. B., on Increased Toluene Production, 637
- Dunn, Mr. J. T., on Calorific Value and Calorific Standards, 13, 34
- Dunn, Mr. M., on the Power of Coal Gas, 218
- Dutch Bureau of Coals, 716
- Dye Industry—
  - A Record Price for Dye, 330
  - America and the, 658
  - British (*see also* British Dyes), 282
  - Calico Printers and the, 78
  - Japanese, 494
  - Mason, Dr. F. A., on the, 543
  - Swiss, 423
  - Tar Oils and the Production of Dyes, 707

- East Hull Gas Company, 578
- East Worcestershire Water Company, 653
- Eastern Counties Gas Managers' Association, 26
- "Eastern Daily Press" on Gas Supply and High Explosives, 605
- Eaton's, Mr. Edmund, Enterprises, 216, 388
- Edden's, Miss H., Gas Cooker, 429
- Edinburgh and Leith Corporations Gas Commissioners—
  - Coal Prices, 155
  - Estimates for 1915-16, 49
  - Price of Gas, 49
  - Wages Question, 279, 333, 549
- Edinburgh Public Lighting, 279
- Edison-Swan High Efficiency Electric Lamp, 633
- Edwards, Mr. R. W., on the British Commercial Gas Association and the Society of British Gas Industries, 185
- Electricity—
  - Central Station Industry, 186
  - Cooking by (*see* Cooking)
  - Differential Prices for, 306
  - Eyesight and, 129, 186
  - Failures, 157, 548, 633
  - Fire Risks and Dangers of, 19, 284, 337, 365, 476, 544
  - Fixed Price System, 579, 633
  - For Artizan Dwellings, 579, 633
  - Future of Gas and, 129
  - Germany and, 530
  - Minimum Rate Supply of, in America, 662
  - Municipal, 245
  - Plant and Foreign Supplies, 80
  - Point Five Suppliers of, 80, 130, 424
  - Power Station, Nuisance Caused by, 443
  - Production Costs, 80
  - Systems of Charging for, 365
  - Undertakings and Coal Supply, 698

- Elliott, Dr. A. H., on the International Gas Congress at San Francisco, 128, 184
- Elliott, Mr. G. H., on Calculating the Diameter of Mains, &c, 531
- Employers' Associations, Federation of, 631
- Employment—
  - And the War, 180
  - Of Discharged Maimed Soldiers, 698
- Emsworth Gas Undertaking, 529
- Enemy—
  - And British Trade, 310
  - Companies, 578
  - Patents, 697
  - Trade Marks and the, 304
- Engineering, Law and, 91
- Engineers' Club and British Engineering, 474
- Engines, Gas—
  - And Oil at the Panama Pacific Exhibition, 183
  - Efficiencies of, 247
  - For Factories, 699, 705
  - Germany and, 247
  - High Power, 535
  - Operating, on Town Gas, 482
  - *v.* Electric Motors, 77, 425
- English and German Methods Compared, 429
- Enlistment—
  - Coal Miners and, 327
  - Gas Workers and, 220, 336, 401, 423, 544
  - Restrictions, 369
  - Skilled Employees and, 389
- Eton Gas Company, 444
- European Gas Company, 722
- Examinations—
  - Gas Engineering and Gas Supply, 657
  - Gas Fitting, 420, 427
- Excess Profit Tax (*see* Taxation)
- Exeter Public Lighting, 552
- Exhibitions—
  - Gas Furnace at Glasgow, 218, 279
  - Lighting, Heating, and Cooking, 16
  - Panama Pacific (*see* Panama)
  - Women's Work, 423
- Exmouth Public Lighting 551
- Explosions—
  - Acetylene, 607
  - Benzol, 159, 212
  - Gas—
    - Action for Injuries Caused by, 218
    - Cases of, 53, 504, 715
  - Street Box, 725
- Exports of Coal and Coke, 23, 127, 131, 242, 268, 311, 422, 631, 642
- Eyesight, Electric Light and, 129, 186

- Factory and Workshops—
  - Lighting of—
    - Electricians and, 476
    - Gaster, Mr. L., on, 473, 488
    - Home Office Report on, 27, 98, 149, 180, 209, 273, 328, 714
  - Power Plant in, 705
  - Report for 1914, 430
- Fahrenheit and Centigrade and Temperature Quotations, 421
- "Fair Tale" Electric Cooker, 19
- Falkirk Gas Undertaking, 504
- Ferndale Gas Company, 444, 496
- Filey Gas and Water Works Undertaking, 182, 724
- Filters for Air Compressors, 257
- Fire, Cases of, 52, 158, 221, 337, 505, 609
- Fireclay Shortage, 551
- Fires—
  - Electric, 186, 425, 530
  - Gas—
    - And Ventilation, 84
    - Building Economies and, 15, 48
    - Development 1913-15, 361, 370, 382
    - Guards for, 159
    - Importance of Flues in the Fixing of, 707
    - Parkinson's, 254
    - Technics of Fixing, 432
- Fittings, Gas and Electric, 306
- Fixed Price Light Company, 579, 633
- Fleetwood Gas Company, 496
- Fleming, Dr. J. A., on Intensive Cultivation, 303
- Fletcher, Russell, and Co., Messrs., 160, 429
- Flues, Importance of, in Fixing Gas Fires, 707
- Fog, Lighting of London during, 327
- Folkestone Gas Company, 495
- Forfar Gas Undertaking, 333
- Forster, Dr. M. O., on a Chemical Intelligence Department of the Board of Trade, 302, 308
- France—
  - Toluol Extraction in, 696, 703
  - War Time Gas Problems in, 77, 81
- Frankfort Gas Company, 16, 445
- Freight Charges, Coal and, 471, 528
- French Gas Professional Syndicate, 77, 81
- Friendly Societies Report, 78
- Fuel Economy—
  - Bone, Professor W. A., on, 76, 447, 450
  - British Association Committee, 124, 128
  - Nicol, Mr. E. W. L., on, 440
- Fuel Problem, Coke and the, 594
- Fulton's, Mr. David, Presidential Address to the Scottish Junior Gas Association, 203
- Furnaces—
  - Electric, 425
  - Electricity *v.* Coke for, 633
  - Gas—
    - Brooks, Mr. B. W., on, 484
    - Exhibition of, at Glasgow, 218, 279
    - For Munition Work, 131
    - Gas Light and Coke Company's Show Room for, 531

- Gas—
  - And Hygiene, 16
  - Architects and, 303
  - Coal *versus*, for Domestic Purposes, 576, 590
  - Crude, Impurities in, 43
  - Electricity Ousted by, 553
  - Electricity *versus*—
    - Comparison of the Cost and Efficiency of, 699
    - "Electrical Industries" on, 306
  - For a Rust Proofing Process, 708
  - Future of Electricity and, 129
  - In Relation to Modern Business, 658
  - Power of, 218
  - Price and Quality of, 711
  - Production and the War, 51
  - Suppliers' Liability for the Supply of, during Strikes, 268, 389, 443
  - Supply in War Time, 322, 388
  - Testing (*see* Testing)
  - Treatment of Iron and Steel by, 125, 138, 312
  - Unaccounted for, Some Reflections on, 704
  - Unfair Statements in Regard to, 365
- Gas and Fuel Industries at Leeds University, 125, 148
- Gas Companies Protection Association, 239, 240, 270
- Gas Engineering and Gas Supply—
  - California University Courses in, 92
  - City and Guilds of London Examiners' Report, 657
- Gas Engineers, Training of, 242, 265, 631, 648
- Gas Fitting—
  - Examinations, 420, 427, 657
  - Instruction in, 103, 368
- Gas Incinerators, A Need for, 208
- Gas Light and Coke Company—
  - Co-Partnership Scheme, 608
  - Explosion of Benzol at Beckton, 159, 212, 265
  - Loss of the Collier "Ignis," 609
  - Official Changes, 15, 305
  - Stand at the Women's Work Exhibition, 423
  - Visit of the London and Southern Junior Association to the Gas Furnace Show Rooms, 531
  - Westminster Public Lighting, 152
  - Woodall's, Sir Corbet, Greeting to Co-Partners, 603
- Gas Liquor, Limeless Concentration of, 144
- Gas Trading, Current Position of, 179, 198
- Gas Workers' Union, 400
- Gas Works—
  - Lighting Restrictions and, 443, 497
  - Plans and Descriptions of—
    - Amsterdam, 634
    - Budapest, 86
    - Hawkhurst, 541
    - Maestricht, 588
    - Manchester (Bradford Road), 218
    - Newcastle-on-Tyne (Elswick), 20
- Gas Works Directory and Statistics, 597
- Gasholder—
  - Heating Water in, to Prevent Freezing, 142
  - Tankless, 126
  - Wrecked by Gale at New Orleans, 377
- Gaster, Mr. L., on the Lighting of Factories and Workshops, 473, 488, 544
- German—
  - And English Methods Compared, 429
  - Goods in Neutral Disguises, 368, 652, 304
  - Mantles, 421, 440
  - Trade, Capturing, 247, 422
- German Continental Gas Company, 179, 211
- Germany—
  - Benzol Supplies in, 197
  - British Gas Undertakings in, 711
  - Coke Oven Gas in, 15
  - Complaint against the Government Mines in, 28
  - Electrical Industry and, 530
  - Phenol Production in, 587
  - Prisoners of War in Gas Works in, 494
  - Sulphuric Acid Supplies in, 488
  - War Lighting in, 17
- Geysers, Dangers of, 55
- Gilchrist, Mr. D. A., on Use of Gas Lime in Agriculture, 589
- Glasgow Gas Department Foremen's Association, 550
- Glasgow Gas Undertaking—
  - Charge for Private Lights, 549
  - Coal Contracts, 397
  - Exhibition of Gas Heated Furnaces, 218, 279
  - Proposed Purchase of the Thornliebank Gas Works, 606
  - Visit to the Workshops by Registered Plumbers, 334
  - Women Meter Inspectors, 397
- Glasgow Registration of Plumbers, 334
- Glass Making, Sheffield University and, 160
- Glassware, Alleged Importation of Austrian, 658
- Gloucester Gas Company, 55, 662
- Glover, Mr. T., on—
  - Naphthalene and Gas Washing, 575, 581
  - Petroleum Vaporizer for Preventing Naphthalene Deposits, 582
  - Training for the Gas Profession, 242, 265
- Glover-West Vertical Retorts, 17
- Godalming, Water Charges at, 663
- Golcar Public Lighting, 283
- Goodall, Clayton, and Co., Messrs., 160
- Goole Gas and Water Undertaking, 244, 529
- Gosport Gas Undertaking, 529
- Grangemouth Gas Supply, 305
- Grays and Tilbury Gas Company, 208
- Greenock Gas Undertaking, 101, 365, 377
- Gretna Railway Disaster, Electrical Press and, 18
- Griffith and Blackburn, Messrs., on the Definition of "Domestic Purposes" in Water Acts, 645

- Hague Gas Works and Peat Carbonization Experiments, 94
- Halifax Electricity Undertaking, 330
- Halifax Gas Undertaking, 104, 330, 506
- Halifax Water Supply, 158, 330
- Hampshire Asylums and Electric Installations, 477
- Hartley, Mr. H., on Gas Fire Development, 361, 370, 382
- Harwich Gas Company, 335
- Hastings, Mr. C. W., on the Work of the Institution of Gas Engineers, 535
- Hawkhurst Gas Company, 541
- Heat Terms, Fahrenheit and Centigrade, 421
- Heat Treatment of Iron and Steel, Research Work on, 125, 138, 312
- Heating—
  - Apparatus Research, 432
  - Best Form of, 104
  - By Electricity—
    - Barker, Professor A. H., on, 630, 710
    - Charges for, 366
  - By Gas—
    - Bakers' Ovens, 426
    - Barker, Professor A. H., on, 630, 710
  - Cotton Mills, 47
- Heats of Combustion, Method Employed for Determining, 431, 478, 532, 583, 635
- Hebden Bridge and Mytholmroyd Gas Board, 183, 365, 578, 632
- Hebden Bridge Public Lighting Restrictions, 280
- Hefner Lamp, Dependence of the Light of the, on Atmospheric Conditions, more Especially Atmospheric Pressure, 378
- Hendon Public Lighting, 722
- Herne Bay Gas Company, 497
- Hertford Sewage Works Arbitration, 372
- High Pressure Air System, Wallwin and Sinnatt's, 315
- High Pressure Gas, The Tenney Process, 200
- Hilgenstock, Mr. R. W., on the Direct Production of Liquor Ammoniæ from Gas Liquor, 436
- Hird, Chambers, and Hammond's Tar Distillation Plant, 150, 211, 262, 278, 333, 448, 502
- Holborn, Lighting Restrictions in, 221
- Holland—
  - Bureau of Coals in, 716
  - Coal Exports to, 127
  - Distribution of Cheap Coke in, 660
  - Openings for British Trade in, 362, 388
- Hollings and Cobb, Messrs., on a Thermal Study of the Carbonization Process, 24
- Holophane, Limited, 106
- Home Office—
  - Memorandum on Chains and other Lifting Appliances, 704
  - Report on Factory Lighting, 27, 98, 149, 180, 209, 273, 328, 476, 488
- Hood and White, Messrs., on Gas as a Case Hardening Agent, 305, 312
- Hornsey Gas Company, 496
- Horwich Street Lighting, 336
- Hot Water Supply (*see* Boilers)
- Howlett and Co., Messrs., 331
- Humphrey Pump Company, 718
- Humphreys, Dr. A. C., Presidential Address to the International Gas Congress, 89
- Hunt, Mr. Charles, on the Origin of the Sliding Scale, 700
- Hydrogen Production for War Purposes, 493
- Hygiene and Gas, 16

- Ilkeston Gas Undertaking, 105, 182, 359
- Illinois University Bulletin (No. 81), 439
- Illuminating Engineering Society—
  - Editorial Comments, 473
  - Gaster, Mr. L., on the Lighting of Factories and Workshops, 473, 488, 544
  - Morris, Mr. J. T., on Recent Developments in Relation to Illuminating Engineering, 708
- Illuminating Engineering Society (American)—
  - Presidential Address of Mr. A. S. M'Allister, 542
  - Report for 1914-15, 434, 491
- Illuminating Power in America, 475
- Illumination (*see also* Lighting)—
  - Calculations, Simplifying, 542
  - Candle Power per Ton of Coal, 473
  - Measurement of, 27
  - Modern, as Applied to Gas Lighting, 371, 594
  - National Committee on, 201
  - Of Barometers, 428
  - Progress, American Illuminating Engineering Society's Report on, 434, 491
- Imperial Continental Gas Association—
  - Antwerp Works, 128
  - Bill, 496, 712
  - Directorate Change, 181
  - Frankfort Gas Company Shares, 16
  - Meeting of Shareholders, 390
  - Report of the Directors, 274
- Incandescent Gas Mantles—
  - British Made Throughout, 495
  - German, 368, 421, 440, 652
  - Recovery of Ash from, 439
- Income Tax—
  - Deductions on Dividends, 48
  - Machinery Depreciation and, 51
  - Municipal Profits and, 451
- Increases in Price of Gas, 49, 50, 51, 53, 54, 104, 105, 148, 208, 220, 282, 450, 552, 605, 608, 653, 723
- India, Sulphate Production in, 183
- Industrial Purposes, Application of Gas to, 131, 481, 632, 656
- Inquiry Circular Nuisance, 362, 527, 598

Institute of Arbitrators, 587
Institute of Hygiene, 16, 103, 104
Institution of Civil Engineers, 366, 645
Institution of Electrical Engineers, 473, 529
Institution of Gas Engineers—
  Badges for Gas Works Employees, 15, 16
  Council Meetings, 16
  Editorial Comments, 420
  Gas Fitting Examinations Report, 420, 427
  Gas Workers and Enlistment, 544
  Women Workers during the War, 445
  Work of the, 535
Institution of Mechanical Engineers, 320
Institution of Municipal Engineers, 503, 596
Institution of Water Engineers—
  Blackburn and Griffith, Messrs., on Definition of the Term "Domestic Purposes," 645
  General Business, 586
Intensive Cultivation, 303
International Gas Congress at the Panama-Pacific Exposition—
  Allen's, Mr. E., Posthumous Contribution, 76, 79
  American Gas Institute Meeting at (*see* American)
  Editorial Comments, 75, 76
  Elliott, Dr. A. H., on, 128, 184
  Presidential Addresses—
    Humphreys, Dr. A. C., 89
    Jones, Mr. E. C., 90, 134
  Review of the Proceedings, 194, 255
Inverness Gas Undertaking, 333, 550
Iowa District Gas Association, 142
Iron and Coal Trades Review and—
  Coal Prices Limitation Act, 78
  Coke and Price Limitations, 488
  Hird, Chambers, and Hammond's Tar Distillation Plant, 150, 211, 278, 333, 448, 502
Iron and Steel, Heat Treatment of, 125, 138

James, Mr., on Continuous Meter Reading, 187
Japan—
  Dye Industry of, 494
  Gas Industry of, 381
Jarrow Railway Accident, 720
Jennings, Mr. A. S., on Painting by Immersion and Compressed Air, 243
Jevons, Mr. H. S., on the British Coal Trade, 320
Jones and Wheeler, Messrs., on the Composition of Coal, 137
Jones, Mr. E. C., Presidential Address to the—
  International Gas Congress, 90
  Pacific Coast Gas Association, 134
"JOURNAL" of Sixty Years Ago, Extracts from, 134, 323, 634
Junior Association Meetings and the War, 178
Junior Institution of Engineers, 699, 705

Keighley Gas Undertaking, 153, 452, 500
Keith and Blackman's Filters for Air Compressors, 257
Keith-Baker Biscuit Baking System, 426
Keith Gaslight Company, 305
Kensington Borough Council and the Toluol Question, 716
Kentucky, Action Arising out of Damage to Pipes by a Steam Roller at, 631
Kettering Gas Company, 578
Kilmarnock Gas Undertaking, 660
Kincardine-on-Forth Gas Supply, 305
Kingstown Council and the Quality of the Gas, 330, 445
Kirkcaldy Gas Undertaking, 333, 397
Knoedler, Mr. E. L., on Recovering Ammonia from Waste Liquor, 704

Labour Combine, 577
Labour Questions (*see also* Co-Partnership, Strikes, *and* Trade Union)—
  Gas Workers and Enlistment (*see* Enlistment)
  Gas Workers' Questions—
    Barnsley, 604, 662
    Bradford, 281
    Carlisle, 653
    Coatbridge, 214
    Edinburgh, 279
    Falkirk, 504
    Leicester, 548
    Maryport, 549
    Neath, 713
    Nottingham, 154
    Oldham, 94, 332
    Rochdale Meter Inspectors, 334
    Wallasey, 105
  Munition Works and Labour at Power and Light Undertakings, 366, 443
  Thrift among Workers, 526
  War Badges for Workers, 15, 336
Lambeth Borough Council and Liability for Accident Caused by Curtailed Street Lighting, 269
Lamp Posts, Luminous Paint for, 663
Lamps—
  Electric—
    Contract Charge for, 634
    Edison-Swan, 633
    Half Watt, 366
    Incandescent in Relation to Illuminating Engineering, 708
    Osram Patents, 698
    Wattage of, 187
  Gas—
    Illegally Lighting, 221
    v. Electric, Comparisons of, 699
Lancaster Gas Undertaking, 47, 282, 607
Lancaster Water Supply, 506
Langlands, Mr. S. B., on Lighting, 660
Launceston (Tasmania) Gas Company, 54
Law and Engineering, Some Points of Contact, 91
Leamington Priors Gas Company, 52
Leeds, The Industries of, 206
Leeds Gas Undertaking—
  A Year's Consumption, 49
  Coke Oven Gas, 362, 381
  Employees and Enlistment, 401
  Visit of the Yorkshire Junior Gas Association to the Meadow Lane Works, 537
Leeds University, Report of the Livesey Professor, 124, 148
Leicester Gas Undertaking, 283, 548
Leigh (Lancs.) Gas and Water Supplies, 604
Leighton, Mr. A. G., on Home Sales of Sulphate of Ammonia, 133
Leiston Gas Company's Lighting Contract, 651
Leng, Mr. C. D., on Coke as Boiler Fuel, 451
Lewes, Professor V. B., Death of, 181, 243, 324, 698
Lighting (*see also* Illumination)—
  Artificial, and Deficient Public Knowledge, 125
  Cotton Mills, 47
  Curtailment of, during the War—
    Accidents Caused through, 269, 332
    Editorial Comments, 14
    Effect of, on the Habits of the Public, 363
    Hebden Bridge and, 280
    Lighting Contracts and, 651
    London Restrictions, 14, 52, 97, 221 (2), 388
    Maryport and, 220
    Non-Compliance with Regulations, 155, 443, 497
    Nottingham Corporation and, 608
    Richmond Corporation and, 216
    Swansea Corporation and, 148
    Torquay Corporation and, 445, 551, 609
    Worthing Corporation and, 505
  Definition of, 77
  During Fog, 327
  Factory and Workshop (*see* Factory)
  In Germany during the War, 17
  Installations, Planning of, 543
  Regulations for Vehicles, 632
  Street, 244
  Works' Yards, 473, 544
Lime, Gas, in Agriculture, 589
Limeless Concentration of Gas Liquor, 144
Limerick Gas Undertaking, 337
Lincoln Gas Undertaking, 206, 451, 605
Lindsay Light Company, 247
Liquor, Waste, Recovering Ammonia from, 704
Liverpool United Gas Company, 183
Liverpool Water Undertaking, 157
Livesey, Mr. F., on the Partial Distillation of Tar in a Wilton Continuous Still, 360, 373
Livesey Professor Report for 1914-15, 124, 148
Llandudno Gas Undertaking, 182
Local Government Board and Municipal Economy, 653
London (*see also* London County Council)—
  Lighting of, during Fog, 327
  Lighting Restrictions in, 14, 52, 97, 221 (2), 388
London and Southern Junior Gas Association—
  Brooks, Mr. B. W., on the Application of Gas to Industrial Purposes, 474, 484
  Editorial Comments, 179, 361, 474, 576
  General Business, 197, 370
  Hartley, Mr. H., on Development of Gas Fires, 361, 370, 382
  Presidential Address of Mr. S. B. Chandler, 179, 198
  Programme of the Session, 85
  Visit to the Gas Light and Coke Company's Gas Furnace Show Rooms, 531
  Westbrook, Mr. L., on Gas *v.* Coal for Domestic Purposes and the Campaign against the Kitchen Range, 576, 590
London Coke Committee, 594
London County Council—
  Death of the Chairman (Lord Welby), 260
  Electricity Supply Question, 653
  Technical Instruction in the—
    Building Industry, 130
    Gas Industry, 103, 219
Londonderry Gas Company, 653
Long, Mr. H., on Co-Partnership, 97
Long Eaton Gas Company, 547
Longwood Gas Company, 423
Loughborough Gas Undertaking, 598
Louth Gaslight Company, 283
Low Temperature Carbonization, 85, 307
Luck, Mr. J. D., on Distribution Extensions and Alterations, 143
Luckiesh, Mr. M., on Eyesight and Electricity, 186
Lurgan Gas Supply, 53, 105, 664
Luton Public Lighting, 282

M'Allister, Mr. A. S., on Simplifying Illumination Calculations, 542
M'Daniel, Mr. A. B., on the Influence of Temperature on the Strength of Concrete, 439
M'Dowall, Steven, and Co.'s Gas Appliances, 449
Maestricht Gas Works, Chamber Ovens at, 588
Magdeburg Gas Company, 282
Mailhe, Professor, on Industrial Uses of Tar Oils, 597, 707
Main, Messrs. R. & A., 55
Mains (*see* Pipes)
Manchester—
  Fatalities through Restricted Lighting in, 332
  Public Lighting Question, 398
Manchester City Council and Domestic Heating Apparatus, 432
Manchester District Institution of Gas Engineers—
  Chambers, Mr. E. V., on Tar Dehydration, 241, 261
  Coal Prices (Limitation) Act, 43
  Editorial Comments, 240, 241
  General Business, 258
  Newbigging, Mr. J. G., on the Bradford Road Gas Works (Manchester), 248
  Visit to the Bradford Road Gas Works of the Manchester Corporation, 248
Manchester Gas Undertaking—
  Consumption, 281
  Litigation Respecting an Accident, 327
  Visit of the Manchester Institution of Gas Engineers to the Bradford Road Works, 248
Manchester Municipal Undertakings and Excess Profits Duty, 551
Manchester Water Supply, 608
Mannesmann Tube Works, 157
Mansfield Gas and Water Undertaking, 182, 214, 330, 399, 506
Mantles (*see* Incandescent)
Manufacture of Gas—
  Examinations in, 657
  From Sewage Sludge, 643
  Tenney Process, 200
Margate Corporation Circular of Inquiry, 527, 598
Margraf, Dr. H., on Coke in Gas Producers, 18
Markinch Distribution Extensions and Alterations at, 143
Marriage, 597
Marylebone Electricity Undertaking, 180
Maryport Gas Undertaking, 249, 662
Maryport Public Lighting, 220
Mason, Dr. F. A., on the Coal Tar Dye Industry, 543
Mason, Mr. W. M., on Gas in Relation to Modern Business, 656
Masonic, 254, 364, 482
Maybole Gas Supply, 365
Mechanical World Diary and Year Book, 609
Mechanical World Electrical Pocket Book, 725
Meldola, Professor R., Death of, 423
Meter, Measuring a Venturi Tube Discharge through a Direct Reading, 706
Meters, Gas—
  Continuous Reading, 187
  Photographic Records of, 183
  Prepayment—
    Effect of, on Copper Coinage, 495, 609
  Testing, in Canada, 217
  Thomas, at the Panama Pacific Exposition, 439
Meters Limited, 284
Metropolitan Water Board—
  Act, 531
  Assessment Questions—
    Chertsey Intake, 601
    Walton Pumping Station, 327
  Death of an Old Official, 181
  Hertford Sewage Works Arbitration, 372
  Money Bills, 55
  New Offices, 54
Michigan Gas Association—
  Editorial Comments, 125, 305
  Rowley, Mr. R. B., on the Doherty Washer-Cooler as a Gas Condenser, 141
  Wagner, Mr. R. B., on the Tenney Process of Gas Manufacture and High Pressure Distribution for Small Towns, 200
  White, Professor A. H., on the Heat Treatment of Iron and Steel, 125, 138
  White and Hood, Messrs., on Gas as a Case Hardening Agent, 312
Middlesbrough Electricity Undertaking, 399
Middlesbrough Gas Undertaking, 148, 272, 399, 495, 664
Middlesbrough Water Undertaking, 399
Midland Association of Gas Engineers and Managers—
  General Business, 132
  Leighton, Mr. A. G., on Home Sales of Sulphate of Ammonia, 133
Midland Institute, 450
Midland Junior Gas Association—
  General Business, 371
  Presidential Address of Mr. F. J. Ward, 371
  Programme, 322
  Stroud, Mr. E., on Modern Illumination as Applied to Gas Lighting, 371
Midland Railway Works, Gas Explosion at, 715
Milbourne, Mr. R. J., on the War on British Trade, 304, 310
Millar, Mr. T. S., on Street Illumination, 244
Mills, Cotton, Lighting and Heating of, 47
Mond Gas Poisoning, Death from, 662
Monmouth Water Undertaking, 281
Moore, Professor B., on Lighting and Heating Cotton Mills, 47
Morland's, Mr. T. O., Presidential Address to the New South Wales and Queensland Gas Institute, 596
Morley Water Supply, 55
Morris, Professor J. T., on Recent Developments in Electric Incandescent Lamps, 708
Mossley Gas Undertaking, 159
Motherwell Gas Undertaking, 49
Motor Waggons for Coke Delivery, 32, 33
Motors, Naphthalene as a Fuel for, 644
Munich Chamber Installation at Darwen, 547
Municipal Engineers, Institution of, 503, 597
Municipal Expenditure and Economy, 389, 653
Municipal Trading—
  Accrington and Stockport Plumbers and the Fixing of Gas Fittings, 609
  Advice to Electricity Concerns, 245
  Excess Profit Tax, 220, 327, 551
  Gas Profit and Income Tax, 451

Municipal Water Works Association, 53
Munitions—
  Gas Apparatus for, 131
  Labour from Power and Light Works and, 366, 443
  Ministry of, 305
  Society of Chemical Industry and, 634

Nantwich Water Undertaking, 598
Naphthalene, Evaporation of, in Air and Coal Gas Vapours, 701
Naphthalene and Gas Washing, 575, 581, 598, 648, 709
Naphthalene Deposits, Glover's Petroleum Vaporizer for Preventing, 582
National Commercial Gas Association (U.S.A)—
  Riley, Mr. H. M., on the Efficiency of Gas Water Heaters, 260
  Salesman's Handbook, 543
National Illumination Committee of Great Britain, 201
National Service, Gas Works and, 306
Natural Gas—
  In America, 257, 447, 483
  Welding and Cutting by, 597
Nautilus Company, Limited, 153
Navan (Co. Meath) Gas Supply, 53
Meath Gas Supply, 54, 443, 554, 713
elson Gas Undertaking, 336, 400
eubeck, Dr. C., on Determination of Benzol in Gas, 264
ew Orleans, Storm Wrecked Gasholder at, 377
ew South Wales and Queensland Gas Institute, 596
ew Tupton Gas Supply, 450
ew York, Astoria Tunnel under East River, 251, 316
ew York Consolidated Gas Company, 183, 253, 316, 448
ewbigging, Mr. J. G., on the—
  Bradford Road Gas Works of the Manchester Corporation, 248
  Future of Gas and Electricity, 129
ewbigging-by-Sea Water Supply, 602
ewcastle-on-Tyne and Gateshead Gas Company, 20, 282, 444, 496
ewcastle-on-Tyne Electric Supply Company, 306
ewington Causeway, Gas Explosion at, 53
ewmarket Council and the Gas Company's Charges, 54, 335
ewport (Mon.) Electricity Undertaking, 425
ewquay Electric Supply Company, 633
ewquay Gas Works, Fire at, 221
ewry Gas Undertaking, 601
ewton, Mr. T., on Technics of Fixing Gas Fires, 432
ey, Mr. A. H., on Synthetic Phenol from Benzol, 587
icholas, Mr. F., on the Central Station Industry, 186
icol, Mr. E. W. L., on Fuel Economy, 477
itrate of Soda in the United Kingdom, 443, 547
itric Compounds from Air, 653
orth British Railway Company, Action against, in Respect of a Gas Explosion, 218
orth of England Gas Managers' Association—
  Dunn, Mr. J. T., on Calorific Value and Calorific Standards, 34
  Editorial Comments, 11, 13, 14
  General Business, 29
  Presidential Address of Mr. Thomas Waddom, 11, 29
  Visit to the Elswick Works of the Newcastle Gas Company, 14, 20
orth Staffordshire Institute of Mining Engineers, 447
orth Warwickshire Water Company, 221, 451
orthwich Gas Undertaking, 496
ottingham and the Lighting Restrictions, 608
ottingham Gas Undertaking—
  Committee, 400
  Financial Position, 398
  Price of Gas, 283
  Workers' Wages, 154
ottingham Water Supply, 608
übling and Wanner, Messrs., on Spontaneous Ignition of Coal, 260

Connor, Lieut.-Colonel Henry, Death of, 528
fficial Changes—
  Alexander, A. J., 477
  Alexander, W. A. D., 477
  Allen, E., 183
  Astbury, E., 183
  Baker, W. J. R., 182, 214
  Barton, H., 365
  Berridge, G., 578
  Boecher, J., 305
  Carpenter, S., 83
  Clegg, J. H., 156
  Colburn, F., 609
  Currie, A., 529
  Duffield, W. W., 244, 529
  Dyer, H. C., 182
  Fazakerley, J., 244
  Gibson, R. E., 183
  Gill, G. M., 632
  Hannibal, T., 156
  Hargreaves, E., 365
  Harrison, E., 156
  Hayes, D., 578
  Hoe, W., 106
  Ibbs, H. E., 15
  Langford, C. G., 305

Official Changes (*continued*)—
  M'Alpine, A., 365
  M'Gregor, A., 182
  Nield, T. H., 365, 578
  North, A., 128
  Nuttall, L. W., 529
  Nutter, W. H., 365
  Russell, W., 305
  Rutter, C. H., 15
  Smallbone, F., 15
  Tobey, H., 182
  Walton, W., 529
  Ward, C. W., 156
  Wellens, E. J., 183, 578
  Wilson, J., 365
  Wright, J. C., 578
Oil and Carbon Products Company, 716
Oldbury Gas Undertaking, 99, 336
Oldershaw, Mr. A. W., on Sulphate of Ammonia as a Manure for Corn, 448
Oldham Gas Undertaking, 94, 332, 336, 365
Oldham Workers' Educational Association, 47
Olin and Parr, Messrs., on the Coking of Coal at Low Temperatures, 307
Organs, Effect of Gas upon, 718
Oriental Gas Company, 399, 497
Osram Lamp Patents, 698
Ossett Gas Undertaking, 128
Ostenberg, Mr. Z., on an Electrically Operated Gas Stove Valve, 202
Ott, Dr. E., on the Dependence of the Light of the Hefner Lamp on Atmospheric Conditions, more Especially Atmospheric Pressure, 378
Ottawa, Glover-West Vertical Retorts at, 196
Ottoman Gas Company, 499

Pacific Coast Gas Association, 92, 134, 136
Pacific Gas and Electric Company, 439
Painting by Immersion and by Compressed Air, 243
Paisley Gas Undertaking, 550, 604
Panama Pacific Exposition—
  Gas and Oil Engines at, 183
  International Congress at (*see* International)
  Thomas Electric Gas Meter at, 439
Pants, Electrically Heated, 580
Parà Gas and Electricity Supply, 275
Paris Gas Company, 103, 444
Parker, Mr. T., on Underground Water in Australia, 704
Parkinson Stove Company, 160, 254
Parliament (*see* Parliamentary Intelligence, p. x.)
Parliamentary War Savings Committee, 105
Parr and Olin, Messrs., on the Coking of Coal at Low Temperatures, 307
Patents and the Defence of the Realm, 180, 422, 697
Paxton's, Bailie, Presidential Address to the British Commeroial Gas Association, 189
Peat Gas, 19, 94, 102
Peat Gas Bye Products, 496
Perkin, Dr. F M., on the British Dye Industry, 282
Personal Paragraphs—
  Alexander, A. J., 477, 578
  Brown, J. W., 529
  Browne, Balfour, 423
  Bywater, F. J., 83
  Carpenter, Charles, 244
  Carpenter, W. J., 632
  Cash, J., 15, 83
  Chandler, V. E., 529
  Clerk, Dugald, 423
  Franken, J. H., 128
  Furniss, Hilton, 423
  Galleway, H., 182
  Gorell, Lord, 181
  Griggs, A. R., 529
  Hands, R. H. M., P. A. M., & K. M., 632
  Higgs, W., 182
  Holliday, J., 128, 529
  Hunter, J., 305
  Legat, A. S., 218
  Lines, G., 106
  Macdonald, J. A., 182, 399
  Rostron, L. W. S., 365
  Smith, J. F., 632
  Smith, T., 182, 399
  Smithells, A., 423
  Thornton, H. M., 381
  Thornton, S. P., 182
  Topley, W. H., 305
  Twigg, W. R., 326
  Valon, C., 128
  Valon, J., 128
  Wellens, E. J., 183
Perth Gas Undertaking, 49, 333, 372, 397
Petit, Herr Th., Process for the Extraction of Sulphur and Cyanogen with Potash Carbonate, 494
Petrol Tax, Commercial Motors and the, 103
Petroleum Vaporizer for Preventing Naphthalene Deposits, 582
Phenol Production in Germany, 587
Photographic Record of Meter Indices, 183
Photometry, Dependence of the Light of the Hefner Lamp on Atmospheric Conditions, more Especially Atmospheric Pressure, 378
Picric Acid Manufacture, 587
Pierce, Mr. R. ff., on Incandescent Lighting and Calorific Value, 145
Pipes—
  Calculating the Diameter of, 531
  Damage to, by Bombs, 156
  Liability for Damage to, by Steam Rollers, 631

Pitch Prices, 441, 495, 544, 648
Plumbers' Certificates Question at St. Helens, 605
Plymouth and Northville (Mich.) Gas Company, 433
Plymouth and Stonehouse Gas Company, 444, 496
Plymouth Corporation Gas Undertaking, 51
Pneumatic Gas Lighting Company, 160
Poeller Plant for the Direct Production of Liquor Ammoniæ from Gas Liquor, 436
Point Five Electricity Suppliers, 80, 130, 424
Pollution of a Stream by Water Works, 653
Pontardulais Gas Company, 282
Pontefract Gas Undertaking, 105
Poplar Electricity Undertaking, 634
Porter, Dr. H. C., on the Output of Benzol by Bye Product Coke Ovens, 494
Porter's, Lieut.-Col. R. S., Presidential Address to the Municipal Water Works Association, 53
Portsea Island Gas Company, 399, 608
Potash Carbonate, Extraction of Sulphur and Cyanogen with, 494
Potteries Gas Supply, 505
Power Gas Corporation, 502, 608, 655
Power Plant in Factories, 699, 705
Pratt, Dr. E. E., on the Dyestuff Industry in America, 658
Presentations—
  Davidson, W. B., 305
  Gibb, W. Doig, 305
  Humphrys, Norton H., 700
  Tanner, C., 529
  Wellens, E. J., 632
Prisoners of War in German Gas Works, 494
Profit Sharing (*see* Co-Partnership)
Profits—
  Gas and Water and the Rates, 272
  Income Tax on Municipal, 451
  Limitation of Controlled Establishments, 423
  Municipalities and Excess, 220, 327, 551
  Statutory Companies' Excess, 268
Provincial Manager, A, on the Supply of Gas in War Time, 322
Provisional Orders for 1916, 320, 547
Public Authorities' Protection Act, 389
Publicity—
  Electrical Industry and, 19
  Gas and Electrical Methods of, 554
Purchase Questions—
  Lurgan Gas, 105, 664
  Radcliffe and Pilkington Gas, 336, 452
  Thornliebank Gas, 606
Purifiers, Control of Gas Passing through, 145

"Qui Vive," on Coke and other Matters, 534, 581

Radcliffe and Pilkington Gas Company, 336, 452
Railway Trains, Gas and, 18, 697, 720
Raschig, Dr., on the Production of Phenol in Germany, 587
Ravensthorpe Water Supply, 221
Reading Public Lighting, 553
Recruiting (*see* Enlistment)
Reduction in the Price of Gas, 206
Research, Scientific and Industrial, 303, 323, 359
Reservoir Embankment Right of Way, 209
Resignations (*see* Official Changes)
Retford Gas and Water Undertaking, 335
Retorts (*see also* Carbonization)—
  Vertical—
    Glover-West System, 17, 196
    Woodall-Duckham System, 396
Retrospect of the Year 1915, 679
Rhenish Water Company, 632
Richmond Corporation and Toluol Question, 716
Richmond Gas Stove and Meter Company, 182
Richmond Public Lighting, 216
Rickmansworth Gas Undertaking, 451
Right of Way over a Reservoir Embankment, 209
Riley, Mr. H. M., on the Efficiency of Gas Water Heaters, 260
Ripon Gas Supply, 662, 716
Rittmann Benzol and Toluol Recovery Process, 482
Road Board and the Use of Crude Tar for Roads, 446
Roads—
  An American Suggestion as to Opening, 553
  Reinforced Concrete for, 596
Robson, Mr. James, Memoirs of, 244
Robson, Mr. S., on the Method Employed for Determining Heats of Combustion, 431, 478, 532, 583, 635
Rochdale Gas Undertaking, 334, 450, 723
Rochester, Chatham, and Gillingham Gas Company, 529
Rockhampton Gas Company, 157
Rollason's Low Temperature Carbonization Process, 85
Rome Water Supply Fifty Years Ago, 28
Romford Gas Company, 423, 578
Roscoe, Sir H. E., Death of, 632
Rossum du Chattel, Heer J. van, on Recovery of Mantle Ash, 439
Rotherhithe Street Box Explosion, 725
Rowley, Mr. R. B., on Developments in the Doherty Washer-Cooler as a Gas Condenser, 141
Rowley Regis Gas Company, 50, 278
Royal Institution Lectures, 645
Royal Meteorological Society, 428
Royal Society, 423
Rugeley Gas Undertaking, 128
Rust Proofing Process, Gas for a, 708

- St. Annes-on-Sea Gas Company, 365
- St. Columb Public Lighting, 156
- St. Helens—
  - Authorized Plumbers' Certificates at, 605
  - Public Lighting Question, 281
- Saffron Walden Gas Undertaking, 296, 451
- Salesmen—
  - Handbook for, 543
  - Training of, 307, 474
- Salford Gas Undertaking, 100
- Salisbury Gas Company, 700
- Saltcoats Public Lighting, 660
- Sanco Gas Mantle Company, 710
- Sander, Dr. A., on the Production of Hydrogen for War Purposes, 493
- " Sanitary Record " on—
  - Gas and Electrical Publicity Methods, 554
  - Gas Incinerators, 208
- Sanquhar Gas Undertaking, 49
- Scarborough Gas Company, 632
- Schön, Herr V., on the Coal and Coke Conveying Plant at the Budapest Gas Works, 86
- Scientific and Industrial Research, 303, 323, 359
- Scotland and Peat for Gas Making, 102
- Scott, Mr. J. J., Presidential Address of, to the Scottish Junior Gas Association, 136
- Scottish Junior Gas Association—
  - Eastern District
    - Luck, Mr. J. D., on Distribution Extensions and Alterations, 143
    - Presidential Address of Mr. J. J. Scott, 136
    - Programme, 81
    - Visit to the Perth Gas Works, 372
  - Western District
    - General Business, 203
    - Presidential Address of Mr. David Fulton, 203
    - Stroud, Mr. E., on Modern Illumination as Applied to Gas Lighting, 594
    - Visit to the Greenock Gas Works, 377
- Sedgley, Trade Union Officials as Committeemen at, 221
- Sedgley Gas Undertaking, 505, 723
- Senn, Mr. H., on Coke for Cooking, 103
- Sewage Sludge for Gas Making, 643
- Shares and Stocks, Sales of, 208, 335, 662, 722
- Sheffield Gaslight Company—
  - Assault Charge against a Labourer, 548
  - Official Change, 183, 578
  - Quality of the Gas, 46
  - Wages Advance to Workers, 275
- Sheffield University and Glass Making, 160
- Shipley Workers' Educational Association, 218
- Showroom Reform, 242, 246, 324
- Sidmouth Gas Undertaking, 49
- Sinking Fund Suspension during the War, 49, 101
- Sinnatt and Wallwin's Burners, 315
- Slaithwaite Gas Undertaking, 423
- Sliding Scale, Originator of the, 495, 577, 598, 696, 700, 709
- Slough Gas Company, 362
- Sluis Gas Supply, 51
- Smith, Messrs. J. & W. B., 212
- Smoke Abatement, Gas Heating and, 84
- Smoke Nuisance, Gas Works and, 47
- Snyders, Herr C. J., on Sewage Sludge for Gas Making, 643
- Society of Arts, 132, 381, 423, 429
- Society of British Gas Industries—
  - Edwards, Mr. R. W., on, 185
  - Firms with German and Austrian Connections, 310
  - Gas Industry and the Government, 310
  - Milbourne, Mr. R. J., on the War on British Trade, 310
  - Prizes for City and Guilds Examinations, 309
  - Report on the Work of the, 309
- Society of Chemical Industry, 302, 308, 634, 658
- Society of Engineers, 91, 631, 700
- Soldiers, Employment of Maimed Discharged, 698
- Somer, Mr. G. J., on Unaccounted for Gas, 704
- South Australian Gas Company, 331
- South Metropolitan Gas Company—
  - Accident at East Greenwich Works, 506
  - Bill, 496, 712
  - Carpenter's, Mr. Charles, Message to Co-Partners, 713
  - Chief Engineership, 632
  - Co-Partnership Accounts, 552
  - Investigations on the Evaporation of Naphthalene in Air and Coal Gas Vapours, 701
  - War Bonus to Employees, 335
- South Shields Gas Company, 553
- South Suburban Gas Company, 269, 529
- South Wales Coke Manufacturers' Association, 722
- South Wales Institute of Engineers, 48
- Southampton Gas Company, 331
- Southend Electricity Undertaking, 53
- Southend Gas Company, 47, 553
- Southend Public Lighting, 723
- Southern District Association of Gas Engineers and Managers—
  - Commercial Sections Report, 367
  - Editorial Comments, 360
  - Education of Gas Fitters, 368
  - General Business, 367
  - Livesey, Mr. F., on the Partial Distillation of Tar in a Wilton Continuous Still, 360, 373
  - Wardell, Mr. R., on Tar Dehydration, 360, 373
- Southport Gas Undertaking, 54, 336
- Sowerby Bridge Gas Undertaking, 157, 553
- Sowerby Bridge Public Lighting, 158
- Sparks, Mr. C. P.—
  - On Candle Power Per Ton of Coal, 473
  - Presidential Address to the Institution of Electrical Engineers, 529
- Spenborough Gas Undertaking, 283
- Spenborough Water Supply, 554
- Speyer, Mr. F. C. O., on Home Sales of Sulphate of Ammonia, 41
- Spontaneous Ignition of Coal, 260
- Springer, Mr. J. F., on Natural Gas for Welding and Cutting, 597
- Stafford Gas and Electricity Undertaking, 336, 505, 605
- Standard Oil Company of California, 632
- Stansfield and Carter, Messrs., on Products and Bye Products of Coal, 135
- Statutory Powers, Gas Companies and, 134
- Steam Rollers, Liability for Damage by, 631
- Steam Waggons, Coke for (*see* Coke)
- Sterne, Mr. E. T., on Condensation from Carburetted Water Gas, 202
- Stockport Plumbers and Municipal Work, 609
- Stockport Public Lighting, 544
- Stockton-on-Tees Chemical Works, 725
- Stoke Newington Public Lighting, 282
- Stoke-on-Trent Gas Undertaking, 505
- Stourbridge Gas Undertaking, 51
- Stoves—
  - Electric Fairy Tale Cooker, 19
  - Gas (*see also* Fires)
    - Edden's, Miss H., " 1915 " Cooker, 429
    - Electrically Operated Valve for, 202
    - Electricians' Unfair Statement in Regard to, 365
- Stratford-on-Avon Gas Undertaking, 712
- Strikes—
  - Aberdare Gas Workers, 604
  - Cheltenham Gas Workers, 214, 330, 393
  - Liability for Failure to Supply Gas during, 268, 389, 443
  - Limerick Gas Workers, 337
  - Paisley Gas Workers, 550, 604
  - Sydney Gas Workers, 496
- Stroud, Mr. E., on Modern Illumination as Applied to Gas Lighting, 371, 594
- Stuttgart Gas Works, Manufacture of Gas from Sewage Sludge at, 643
- Suffocation by Gas, 281, 396, 502, 552, 662, 663
- Suicide by Gas, 552
- Sulphate of Ammonia—
  - Advantages of, 324
  - Contract Litigation, 712
  - Exports of, 587, 697, 709, 717
  - Home Sales of, 41, 133, 268, 324, 305
  - Indian Production of, 183
  - Potato Crops, 206
  - Scottish Farmers and, 609
  - Wheat Growing by, 366, 448
- Sulphate of Ammonia Association, 324
- Sulphur and Cyanogen Extraction with Potash Carbonate, 494
- Sulphur Dioxide Recovery, 364
- Sulphuric Acid—
  - New Method of Manufacture, 477
  - Supplies in Germany, 488
- Swansea Public Lighting, 148
- Swiss Coal Tar Dyes, 423
- Sydney Gas Strike Award, 496
- Sydney Water Supply, 492

- Tar—
  - Contract Litigation, 548
  - Dehydration, 241, 261, 360, 375
  - Distillation, 150, 211, 262, 278, 333, 363, 373, 448, 502
  - Oils—
    - In Relation to the Production of Dyes, 707
    - Industrial Uses of, 597, 707
  - Retort Heating by, 598
  - Treated Roads, Road Board and the Use of Crude Tar for, 420, 446
- Taxation, War, 220, 268, 327, 551
- Taylor, Mr. C. P., on Gas Engine Efficiencies, 247
- Taylor, Mr. G., on Benzol, 639
- Technical Instruction in the Gas Industry, 103, 219
- Tees Benzol Syndicate, 103
- Tees Valley Water Board, 396, 663
- Temperature Quotations, 421
- Tenney Process of Gas Manufacture and High Pressure Distribution for Small Towns, 200
- Testing Gas—
  - In America, 475
  - In Canada, 217
  - Toluol Recovery and, 424, 500, 509, 525, 716
- Testing Gas and Meters in Canada, 217
- Thermal Study of the Carbonization Process, 24
- Thetford Gas Works and the Lighting Restrictions, 443
- Thomas, Mr. J. S. G., on Evaporation of Naphthalene in Air and Coal Gas Vapours, 701
- Thomas Gas Meter, 439
- Thorium, The Supply of, 247
- Thornliebank Gas Works, 606
- Thrift among Workers, Government and, 526
- " Times " Engineering Supplement on Total Heat, 242
- Tinsley Park Colliery, Coking and Bye Product Plant at the, 437
- Tipton—
  - Calorific Value Question at, 278
  - Death from Mond Gas Poisoning at, 662
- Tipton Gas Undertaking, 284, 554
- Toluene, Increased Production of, 637
- Toluol Recovery in Gas Works during the War—
  - British Commercial Gas Association and, 598
  - " Eastern Daily Press " on, 605
  - Editorial Comments, 123, 177, 240, 301, 525, 629, 697, 703
  - France and, 696, 703
  - Glover, Mr. T., on, 575
  - Local Authorities and Gas Testing, 424, 500, 509, 525, 716
  - Naphthalene Troubles and, 177, 575, 598
  - Rittmann Process, 482
  - Small Works and, 301, 388
- Tookey, Mr. W. A., on Power Plant in Factories, 699, 705
- Toronto Consumers' Gas Company, 422, 445, 716
- Torquay Public Lighting, 445, 551, 609
- Tottenham District Light, Heat, and Power Company, 390
- Trade, British and German, and the War, 304, 422
- Trade Marks and the Enemy, 304
- Trade Union—
  - Combine, 577
  - Membership, 78
  - Officials as Committeemen, 221
- Training of Gas Engineers, 242
- Trim (co. Meath) Gas Undertaking, 282, 653
- Trinitrotoluene, Risk of Workers on, 547
- Truro Gas Company, 53, 451
- Tunnel, The Astoria (New York), 241, 251, 316
- Turbine, The Gas, 636
- Turkey, Stoppage of Gas Supply in, 53
- Turner, Mr. S. G., on Contact of Law and Engineering, 91
- Tynemouth Gas Company, 181
- Tynemouth Water Undertaking, 496, 602

- Unger, Mr. J. S., on Limeless Concentration of Gas Liquor, 144
- United Gas Works Development Company, 209, 282, 327, 712
- United Tube Corporation, 208
- Uxbridge Gas Company, 444

- Valve for Gas Stoves, Electrically Operated, 202
- Vehicles, New Lighting Order for, 632
- Ventilation, Gas Fires and, 84
- Venturi Tube Discharge, Measuring a, through a Direct Reading Meter, 706
- Vienna, Coal Famine in, 609

- Waddom's, Mr. T., Presidential Address to the North of England Gas Managers' Association, 11, 29
- Waggons, The Pooling of Private, 575, 598, 630, 648, 711
- Wagner, Mr. R. B., on the Tenney Process of Gas Manufacture and High Pressure Distribution for Small Towns, 200
- Wakefield Water Undertaking, 496
- Wales and Monmouthshire District Institution of Gas Engineers and Managers—
  - Editorial Comments, 12
  - General Business, 36, 43
  - Presidential Address of Mr. A. W. Branson, 36
  - Speyer, Mr. F. C. O., on Home Sales of Sulphate of Ammonia, 41
- Walker and Wallsend Gas Company, 552
- Wallasey Gas Undertaking, 105
- Wallwin and Sinnatt's Burners, 315
- Walsall Gas Undertaking, 401
- Wandsworth Borough Council and Gas Testing, 554
- Wandsworth Gas Company's Coal Supply, 206
- Wanner and Nübling, Messrs., on Spontaneous Ignition of Coal, 260
- Wantage Gas Undertaking, 148
- War, The—
  - Badges for Workers, 15, 336
  - Bonus to Workers, Council Surcharged for, 601
  - British Trade and, 310, 422
  - Capital Raising during (*see* Capital Raising)
  - Employment during, 180
  - Employment of Maimed Discharged Soldiers, 698
  - Enlistment Restrictions (*see* Enlistment)
  - Exports of Coal and Coke during (*see* Coal and Coke)
  - French Gas Works Problems during, 77, 81
  - Gas and Water Engineers and Staffs and, 15, 83, 128, 181, 220, 305, 336, 369, 396, 401, 423, 529, 716, 724
  - Gas Production and, 51
  - Gas Supply during, 322
  - Gas Works and National Service, 306
  - Intensive Cultivation during, 303
  - Miners and Enlistment, 327
  - Profit Limitation (*see* Profits)
  - Sinking Fund Suspension during, 49, 101
  - Taxation (*see* Taxation)
  - Toluol Recovery in Gas Works during (*see* Toluol)
  - Wages of Prisoners of War in German Gas Works, 494
  - Women Workers during, 279, 397, 445
- Ward, Mr. F. J., Presidential Address of, to the Midland Junior Gas Association, 371
- Wardell, Mr. R., on Tar Dehydration, 360, 375
- Warrington Gas Undertaking, 393
- Warwick Gas Company, 83
- Washer-Cooler, The Doherty, as a Gas Condenser, 141
- Washington Bureau of Standards Gas Supplies Circular, 475
- Waste, Professor W. A. Bone on Value from, 76

ter—
upply—
  County Councils and, 503
  Definition of "Domestic Purposes," 645
  Rates, The Basis of, 651
Underground, in Australia, 704
ter Gas—
ondensation from, 202
eparation of, into its Constituents, 534
ter Heaters (*see* Boilers)
tson, Mr. G. W., on Coke for Steam Waggons, 154
ttleworth, Mr. D. R., on Bye Product Coking and Chemistry, 321
ardale and Consett Water Company, 181
dnesbury, Failure of the Electric Light at, 548
lding and Cutting by Natural Gas, 597
st, Mr. J., on the Advantages of Sulphate of Ammonia, 324
est Bromwich Gas Undertaking, 106, 548
stbrook, Mr. W. L., on Gas *v.* Coal for Domestic Purposes, 576, 590
stgate and Birchington Gas Company, 157
stinghouse Gas Engines for Town Gas, 482
Vestminster Gazette" on Stripping Town Gas for Benzol, 549
stminster Public Lighting, 152
st's Gas Improvement Company, 17
xford Gas Company, 220
eeler and Jones, Messrs., on the Composition of Coal, 137
essoe Foundry Company, 700
itby Gas Works, 182
ite, Professor A. H., on the Heat Treatment of Iron and Steel, 125, 138
ite and Hood, Messrs., on Gas as a Case Hardening Agent, 305, 312
dlake, Mr. H. C., on Care and Maintenance of the De Brouwer Charging and Discharging Plant, 480, 536, 585
gan Gas Undertaking, 279, 446
kinson, Mr. G., on Electricity in the Home, 530
lls, 33, 181, 307, 315, 372, 439, 474, 541
lton Gas Undertaking, 104
lton's Tar Dehydrating Plant, 373
mbledon, Fixed Price Light Company and, 633
ndsor Water Supply, 101
king Water and Gas Company, 651
lverhampton Water Supply, 158
men Workers during the War, 279, 397, 445
men's Work Exhibition, 423
odall's, Sir Corbet, Greeting to Gas Light and Coke Company's Co-Partners, 603
odbridge Water Company, 722
rkington Gas Undertaking, 396
rks Yards, Lighting of, 473, 544
rksop Water Undertaking, 506
rthing—
  Discontinuance of Gas Tests at, 553
  Lighting Restrictions at, 505
ight and Co., Messrs. J., 131, 384
irzburg Gas and Water Supply, 632

rmouth Public Lighting Question, 608
tes, Mr. H. J., on Gas Fires and Ventilation, 84
adon Water Company, 496
ar 1915, Retrospect of the, 679
rk Gas Company, 52, 506
rkshire Junior Gas Association, 537
ill, Mr. A., on the Dundee Gas Works, 379

ppelin Raids and Damage to Gas Mains, 156

REGISTER OF PATENTS.

he names printed in italics are those of persons by whom patents have been communicated.]

rd, K., and M'Geachin, J.—Fires, 267
lridge, J. G. W.—Charging and Discharging Retorts, 599
the, F. C.—Destructive Distillation of Bituminous Coal, 97
nova, V.—Lighting and Extinguishing Burners, 599
rpenter, H. A., Warner, A. W., and the Riter-Conley Manufacturing Company — Retort Closing Mechanism, 208
rs, B., and Palmer, W. D.—High Pressure Lamps, 97
ssella, Leopold, and Co.—Manufacture of Substituted Products of Toluene, 442
rk, A., and Whitworth, H.—Meter for Automatic Registering, 441
vis, H. N., and Twigg, W. R.—Air Blast Burners, 443
akes, Limited, and Drake, W. A.—Regenerative Furnaces, 650
ckham, A. M'D.—
  ow Temperature Carbonizing Plant, 95, 268
  Ventilation of Retort Houses, 546
rich and Graetz—Lamp for Gas under Pressure, 711
ans, E. V., and the South Metropolitan Gas Company—Eliminating Sulphur from Oils, 545
Fairweather, W., J., & W. R.—Bags for Gas Engines, 545
Gee, B., and M'Intire, C. S.—Mixing Air with Gas, 441
Gill, G. M., Donald, D. B., and Jenkinson, W.—Breaking Down Clinker in Gas Furnaces, 711
Gill, W. A.—Valve Mechanism for Gas Engines, 649
Gilman, F., and Clements, G. F.—Valves for Controlling the Flow of Fluids, 649
Grafton, W.—Controllers for Gas Fires, 710
Güttner, M.—Blowers and Compressors, 710
Hall, E. L.—Purification of Gases, 442
Hibberd, C. E., and Goad, F. L.—Meters, 207
Hickman, T. M.—A New Fuel, 95
Keith, J. & G.—Automatically Lighting and Extinguishing Gas Lamps, 650
Lamplough, F.—Low Temperature Distillation, 266
Lindemann, A. J., and the A. J. Lindemann and Hoverson Company—Combined Solid Fuel and Gas Burning Stove, 546
M'Gowan, R. R.—Burners for Welding, 546
M'Lachlan, R. W.—Gas Governors, 146
Marsh, R. G., and Walter, C. M.—High Pressure Meter Mechanism, 325
Mathews, C. L.—Gas Cooking Stoves, 267
Muller, J. L., and Bonnet, J.—Manufacture of Mantles, 649
Neumann, R.—Distilling Tar, 267
Noonan, J. H.—Gas Cooking Apparatus, 147
Oil and Carbon Products, Limited—Separating Volatile Products from Solid Carbonaceous Materials, 206
Ordish, F. W., and Dempster, R., and Sons, Limited—Screening Coke, 97
Fickard, W. and Bentley, J. E.—Regulators, 207
Pintsch, Julius, Aktiengesellschaft—Vertical Retorts, 96
Pope, C. E.—Washers, 266
Porges, P., and Strache, H.—Carburetting Water Gas, 326
Prioleau, J. R. H. & W. L. St. J.—Coal Distillation Apparatus, 147
Pritchard, T. W.—Distillation of Wood, 96
Ransford, R. B.—Manufacture of Substituted Products of Toluene, 442
Rasch, L., and Watkinson, F.—
  Operating Gas Cocks, 442
  Pilot Lights, 146
Rigby, T., and Wetcarbonizing, Limited—
  Production of Ammonia Compounds, 545
  Recovering Ammonia in the Form of Sulphate from Gases, 96
Smith, H. E.—Using Exhaust Steam in the Manufacture of Water Gas, 545
Società Italiana Prodotti Esplodenti and F. Quartieri—Trinitrotoluene Manufacture, 96
Stevenson, J., and Williams, O. R.—Lamp Suspending and Lowering Device, 599
Still, Carl (Firm of)—Removing and Loading Coke on a Quenching Bench, 650 (2)
Stott, V. H., and Schofield, L.—Water Heaters, 267
Troquay, J.—Controlling Gas Valves and Cocks, 600
Turner, W.—Cocks or Valves, 600
Walch, W.—Preliminary Cooling of Incandescent Coke, 325
Wellington, S. N.—Distillation of Coal, 325

Ammonia Compounds, Production of—Rigby, T., and Wetcarbonizing, Limited, 545
Bags for Gas Engines—Fairweather, W., J., & W. R., 545
Blowers and Compressors—Güttner, M., 710
Burners—
  Air Blast—
    Davis, H. N., and Twigg, W. R., 443
  Lighting and Extinguishing—
    Canova, V., 599
    Keith, J. & G., 650
    Rasch, L., and Watkinson, F., 442
  Welding—
    M'Gowan, R. R., 546
Charging and Discharging Retorts — Aldridge, J. G. W., 599
Clinker Removing Tool—Gill, G. M., Donald, D. B., and Jenkinson, W., 711
Coal, Distillation of—
  Blythe, F. C., 97
  Duckham, A. M'D., 95, 268
  Lamplough, F., 266
  Oil and Carbon Products, Limited, 206
  Prioleau, J. R. H. & W. L. St. J., 147
  Wellington, S. N., 325
Cocks, Operating, from a Distance—
  Canova, V., 599
  Keith, J. & G., 650
  Rasch, L., and Watkinson, F., 442
Cocks or Valves—
  Troquay, J., 600
  Turner, W., 600
Coke—
  Preliminary Cooling of—Walch, W., 325
  Removing and Loading on a Quenching Bench—Still, Carl (Firm of), 650 (2)
  Screening—Ordish, F. W., and Dempster, R., and Sons, Limited, 97
Cooking Apparatus—
  Lindemann, A. J., and the A. J. Lindemann and Hoverson Company, 546
  Mathews, C. L., 267
  Noonan, J. H., 147
Engines, Gas—Gill, W. A., 649
Fires—Aird, K., and M'Geachin, J., 267
Fires, Controller for—Grafton, W., 710
Fuel, A New—Hickman, T. M., 95
Furnaces, Regenerative—Drakes Limited and Drake, W. A., 650
Governors—M'Lachlan, R. W., 146
Lamp Suspending and Lowering Device—
  Stevenson, J., and Williams, O. R., 599
Lamps, High Pressure—
  Cars, B., and Palmer, W. D., 97
  Ehrich and Graetz, 711
Lighting and Extinguishing Burners—
  Canova, V., 599
  Keith, J. & G., 650
  Rasch, L., and Watkinson, F., 442
Low Temperature Carbonizing Plant—
  Duckham, A. M'D., 95, 268
  Lamplough, F., 266
Mantle Manufacture—Muller, J. L., and Bonnet, J., 649
Meters—
  Clark, A., and Whitworth, H., 441
  Hibberd, C. E., and Goad, F. L., 207
  Marsh, R. G., and Walter, C. M., 325
Mixing Air with Gas—Gee, B., and M'Intire, C. S., 441
Oils, Eliminating Sulphur from—Evans, E. V., and South Metropolitan Gas Company, 545
Pilot Lights—Rasch, L., and Watkinson, F., 146
Purification of Gases—Hall, E. L., 442
Regulators—Pickard, W., and Bentley, J. E., 207
Retort House Ventilation—Duckham, A. M'D., 546
Retorts (*see also* Coal Distillation)—
  Charging and Discharging—
    Aldridge, J. G. W., 599
  Closing Mechanism for—
    Carpenter, H. A., Warner, A. W., and the Riter-Conley Manufacturing Company, 208
  Vertical—
    Pintsch, Julius, Aktiengesellschaft, 96
    Wellington, S. N., 325
Stove, Combined Solid Fuel and Gas Burning—Lindemann, A. J., and the A. J. Lindemann and Hoverson Company, 546
Sulphate of Ammonia Manufacture—Rigby, T., and Wetcarbonizing, Limited, 96
Sulphur, Eliminating, from Oils—Evans, E. V., and South Metropolitan Gas Company, 545
Tar Distillation under Vacuum—Neumann, R., 267
Toluene, Manufacture of Substituted Products of—Ransford, R. B. (*Leopold Cassella and Co.*), 442
Trinitrotoluene Manufacture—Società Italiana Prodotti Esplodenti and F. Quartieri, 96
Valve Mechanism of Gas Engines—Gill, W. A., 649
Valves for Controlling Flow of Fluids—Gilman, F., and Clements, G. F., 649
Washers—Pope, C. E., 266
Water Gas—
  Carburetting—Porges, P., and Strache, H., 326
  Using Exhaust Steam in Making—Smith, H. E., 545
Water Heaters—Stott, V. H., and Schofield, L., 267
Wood, Distillation of—Pritchard, T. W., 96

Applications for Letters Patent, 55, 97, 158, 208, 283, 326, 400, 453, 506, 554, 601, 663, 724

CORRESPONDENCE.

Alpha—Tar for Retort Setting Heating, 598
B.Sc.—Benzol Explosion at Beckton, 265
Barker, A. H.—Gas Fires and Electric Radiators, 710
Bell, J. F.—Pooling of Coal Waggons, 598
Bird, A.—Sulphate of Ammonia and Potato Crops, 206
Blagden, Waugh, and Co.—Pitch Prices in London, 441, 544, 648
Bone, W. A.—Government Scheme for Organizing Research, 323
British Commercial Gas Association—
  Gas Industry and the Government, 265
  Naphthalene Troubles, 598
Canadian Calorific Standard—Higman, O., 495
Carpenter, W. T.—Concerning Naphthalene, 709
Chicago—Control of Gas Passing through Purifiers, 145
Clayton, Thomas (Oldbury)—Creosote Prices, 495
Cunnington, A.—Lighting of Works Yards, 544
Curtis's and Harvey—Imported Mantles, 495
Dawson, A.—Home Sales of Sulphate of Ammonia, 324
Duffield, W. W.—City of London Gas Testing, 325
Dunn, W. T.—Enlistment of Gas Workers, 544
Edwards, R. W.—
  Alliance and Dublin Gas Company's Affairs, 145, 206
  Originator of the Sliding Scale, 495
Ellis, H. D.—Originator of the Sliding Scale, 598
Gas Engineer—Late Professor Lewes, 324
Glover, T.—Training for the Gas Profession, 265
Grimwood, C. G.—Toluol and Small Works, 388
Harman, E. A.—Storage of Ammoniacal Liquor, 495
Helps, W. D.—Gas Companies' Show Rooms, 324
Hewett, J.—Impurities in Crude Gas, 43

Higman, O.—Canadian Calorific Standard, 495
Hollander—British Trade Opening in Holland, 388
Institution of Gas Engineers—Enlistment of Gas Workers, 544
Johnson, H. L.—Pooling of Railway Waggons, 648
Jones, H. E.—
  Origin of the Sliding Scale, 709
  Wandsworth Gas Company's Coal Supply, 206
"JOURNAL," Editor of—Prices of London Creosote, 544
"JOURNAL" Reporter—Price of London Pitch, 495
Lancashire Commercial Section—Coal Prices (Limitation) Act, 1915, 43
Macleod, J.—Training for the Gas Profession, 648
Marshall, F. D.—Mantles, Imported, 440
Mason, W. M.—
  Gas Industry and the Government, 265
  Naphthalene Troubles, 598
Meunier, S., and Halliwell, S. E.—Coal Prices (Limitation) Act, 1915, 43
Mitchell, J.—Gas Companies' Show Rooms, 325
Nicol, E. W. L.—Fuel Economy from the National Standpoint, 440
Nonulus—Alliance and Dublin Gas Company's Affairs, 145, 206
Northern Gas—Circulars of Inquiry, 598
Pierce, R. ffrench—Incandescent Lighting and Calorific Value, 145
Small Provincial—Case of the Small Works, 388
Sulphate of Ammonia Association—
  Exports of Sulphate, 709
  Home Sales of Sulphate, 324
T. W.—Naphthalene, 648
Watson, D. Milne—Exports of Sulphate of Ammonia, 709
West, John—Advantages of Sulphate of Ammonia, 324

Alliance and Dublin Gas Company—Edwards, R. W., 145, 206
Ammoniacal Liquor, Storage of—Harman, E. A., 495
Benzol Explosion at Beckton—B.Sc., 265
Circulars of Inquiry—Northern Gas, 598
City of London Gas Testing—Duffield, W. W., 325
Coal Prices (Limitation) Act, 1915—Lancashire Commercial Section (Meunier, S., and Halliwell, S. E.), 43
Control of Gas Passing through Purifiers—Chicago, 145
Creosote Prices—
  Editor of the "JOURNAL," 544
  Thomas Clayton (Oldbury), 495
Enlistment of Gas Workers—Dunn, W. T. (Institution of Gas Engineers), 544
Fuel Economy from the National Standpoint—Nicol, E. W. L., 440
Gas Fires and Electric Radiators—Barker, A. H., 710
Gas Industry and the Government—Mason, W. M. (British Commercial Gas Association), 265
Government Scheme for Organizing Research—Bone, W. A., 323
Holland, British Trade Opening in—Hollander, 388
Impurities in Crude Gas—Hewett, J., 43
Incandescent Lighting and Calorific Value—Pierce, R. ffrench, 145
Lewes, Late Professor—Gas Engineer, 324
Lighting of Works Yards—Cunnington, A., 544
Mantles, Imported—
  Curtis's and Harvey, 495
  Marshall, F. D., 440
Naphthalene Troubles—
  Carpenter, W. T., 709
  Mason, W. M. (British Commercial Gas Association), 598
  T. W., 648
Pitch Prices in London—
  Blagden, Waugh, and Co., 441, 544, 648
  "JOURNAL" Reporter, 495
Pooling of Railway Waggons—
  Bell, J. F., 598
  Johnson, H. L., 648
Show Rooms, Gas Company's—
  Helps, W. D., 324
  Mitchell, J., 325
Sliding Scale, Originator of the—
  Edwards, R. W., 495
  Ellis, H. D., 598
  Jones, H. E., 709
Small Works, The Case of the—Small Provincial, 388
Sulphate of Ammonia, Advantages of—West, John, 324
Sulphate of Ammonia and Potato Crops—Bird, A., 206
Sulphate of Ammonia Exports—Sulphate of Ammonia Association (D. Milne Watson), 709
Sulphate of Ammonia Home Sales—Dawson, A. (Sulphate of Ammonia Association), 324
Tar for Retort Setting Heating—Alpha, 598
Toluol Extraction and Small Works—
  Grimwood, C. G., 388
  Small Provincial, 388
Training for the Gas Profession—
  Glover, T., 265
  Macleod, J., 648
Wandsworth Gas Company and Its Coal Supply—Jones, H. E., 206

LEGAL INTELLIGENCE.

Airdrie Sheriff Court—Coatbridge Picture House *v.* Coatbridge Gas Company, 268, 389
Dundalk Quarter Sessions—Dundalk Gas Company's Assessment Appeal, 147
Edinburgh Sheriff Court—Seizure of Mantles, 652
High Court of Justice—
  Chancery Division—
    Dexter *v.* Aldershot Urban District Council, 443.
    Tynemouth Corporation *v.* Newbiggin-by-the Sea Urban Council, 602
  Divisional Court—
    Crane *v.* South Suburban Gas Company, 269
  King's Bench Division—
    Brown *v.* Lambeth Borough Council, 269
    Donnelly *v.* First Garden City, 712
    Firth Blakeley, Sons, and Co. *v.* United Gas Works Development Company, 209
    Hutchison's, Mr. A. J., Motor Accident, 548
    Leigh *v.* Tottenham Light, &c., Company, 390
    Leiston Gas Company *v.* Leiston-cum-Sizewell Urban Council, 651
    Strange *v.* Davis Gas Stove Company, 390
    Waddell *v.* East Worcestershire Water Company, 653
    Waters and Co. *v.* Cochrane and Co., 712
    Woking Water and Gas Company *v.* Parker, 651
House of Lords—
  Chertsey Union *v.* Metropolitan Water Board, 327, 601
  Myers *v.* Bradford Corporation, 389
Ireland, King's Bench Division in—Connell *v.* Trim Urban Council, 653
Lancashire Chancery Court—Reservoir Embankment of the Bolton Corporation, 209
London Quarter Sessions—Brompton and Kensington Electricity Company's Rating Appeal, 443
Manchester County Court—Compensation Claim, 327
Neath Magistrates—A Strike and a Gas Account, 443
Official Referee—Hurst and Co. *v.* William Sugg and Co., 327
St. Augustine's Petty Sessions—Herne Bay Gas Works and Lighting Restrictions, 497
Sheffield Police Court—Assault by a Gas Works Labourer, 548
Thetford Magistrates—Failing to Reduce Light at the Gas Works, 443
West Riding Assizes—
  Cortonwood Collieries Company *v.* Burnden Tar Company (Bolton), 548
  Joseph Morton *v.* R. & J. Dempster, 547

Coke, Accident while Delivering a Load of, 389
Coke Contract, Breach of a, 390
Compensation (Workmen's) Litigation, 327, 390
Darwen "Munich" Chamber Installation, 547
Electrical Power Station Nuisance, 443
Light, Excessive, from Gas Works, 443, 497
Lighting Contracts and Lighting Restrictions, 651
Mantles, Seizure of, 652
Metropolitan Rating Appeal, A, 443
Molten Lead, Damages Caused by, 269
Public Authorities Protection Act, 389
Right of Way on a Reservoir Embankment, 209
Stream Pollution, A Pumping Station and, 653
Strike, Sequel to a, Causing an Interruption of Gas Supply, 268, 389, 443
Sulphate of Ammonia Contract, A Disputed, 712
Tar Contract, A Disputed, 548
Taxi Cab Collision, Action through a, 269
United Gas Works Development Company in the Courts, 209, 327, 712
Valuation Appeals, 147
Water Intake, Rating of a, 327, 601
Water Rates, Basis of, 651

PARLIAMENTARY INTELLIGENCE.

Artificial Fertilizers, 268
Bills and Orders for 1916, Notices of, 444, 496, 547 712
British Dyes, Limited, 268
British Gas Undertakings in Germany, 711
Chemical Manures, 651
Coal Mining Industry and Enlistment, 327
Coal Prices, 268
Colonel Edmund Eaton, 389
Controlled Establishments, 443
Finance Bill, 327
Income Tax, Machinery Depreciation and, 51
Lighting of London during Fog, 327
London Lighting Regulations, 388, 651
Municipal Expenditure, 389
Munitions of War Bill, 651
Nitrate Shortage, 443, 547
Peat Gas Bye Products, 496
Price and Quality of Gas, 711
Privately Owned Waggons, 711
Recruiting Skilled Employees, 389
Reduction in the Power of Gas, 651
Statutory Companies' Excess Profits, 268
Sulphate of Ammonia, 651
T.N.T., Risk to Workers on, 547

Progress of Bills, 268

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EDITORIAL NOTES.

Labour, and Gas and Coke Trading.

THE President for the year of the North of England Gas Managers' Association is Mr. Thomas Waddom, the long-time and the highly-honoured Secretary of the Newcastle and Gateshead Gas Company. Mr. Waddom stands for much in the large northern Company, for the devising of whose commercial policy, it is notorious, he has been largely responsible; and a grand thing for the Company has been hat, with changed conditions, their monitor has shown flexi- ility in adaptation. The robustness of his views has been ore than once seen through the entrance into the public life f the industry that the newer organizations have permitted. t one time, one heard of, but rarely saw, some of the men ho were behind the scenes doing important work for the ndustry. They were hidden away simply because they had ot by right, by courtesy, or by good fortune, had bestowed n them the title of "engineers" or "managers." Change, owever, has been effected in this respect in the life of the in- lustry chiefly through the organizations that are now devoted o developing the commercial opportunities of the industry. ut the North of England Gas Managers' Association have, nd alone among our technical bodies, for many years shown y their elections that their presidential chair is not reserved xclusively for gas engineers and managers. They have had residents from allied industries; and they have bestowed he honour of the chair upon secretaries of gas undertak- ngs. Among officials generally whatever their designation, r. Waddom stands prominently as a champion of the in- ustry's interests; and he is not therefore out of place as resident of any gas managers' organization.

In his address on Saturday, the President spoke of the war. e cannot get away from it. It is before us wherever we o; it is practically *the* one topic of conversation; and its ffects and responsibilities are upon every individual. But hough it has supremacy in our minds over everything else, e country cannot afford that the people at home shall be e least negligent of ordinary interests. Industries, men, nd women have their parts to perform; and the better e performance, the better will it be for the common good f the country in these severe and critical times. It is on is ground that the gas industry in its current discussions onsiders from all points of view what can be done in order lighten the war's effects. The labour trouble is the one at Mr. Waddom regards as predominant; and he supports is opinion in this matter by quoting figures as to employ- ent by the Newcastle Gas Company during recent years, nd as to their maximum requirement in winter. It is to e ability to comply with the maximum need for labour to hich the President looks forward with some misgiving. In e recruiting of men, he therefore trusts that the Govern- ent will, in whatever measure they take to obtain men for e vigorous prosecution of the war, recognize the essential aracter of the gas industry—"essential" in several ways t only to the community, but in connection with the war. ecruiting has hitherto been prosecuted on unsystematic es, and without discrimination. This could not be avoided; t the time has arrived when both system and discrimina- n can be introduced. One of the Committees advising e Government under the National Registration Act is make special inquiry into the question of industrial ex- nptions in relation to enlistment for both the forces and unitions work, so that it is hoped the gas industry will be ved much further trouble. Here we hinge upon a point policy for the war period. Though they had not got to the aximum requirement for men in the year's gas business, t away at Midsummer the Directors of the Newcastle as Company came to the conclusion that the only section their operations in which they could make any material duction of labour was the Distribution Department, by curtailing the supply of new appliances other than those necessary for the requirements of the war. This was rather a drastic measure; but the Directors of the Company and their advisers know their business much better than outsiders. At the same time, our feeling is that such a course is one that should only be taken as a very last resort. For a progressive Company such as that at Newcastle, which has been to the forefront in developing gas applications, and whose system in this regard is a model one, such a decisive break in the continuity of business development is one to be deplored if really necessary, and more to be deplored if made while not altogether necessary. The President says he is pleased to say the public have most patriotically co-operated with the Company in postponing the fixing of gas appliances. But is it only postponement? Will the loss of business from new domestic appliances which might have been, but are not to be, fixed during the war be compensated quickly when there is a resumption of business in new connections. It is difficult to say; but picking-up as a rule is not so quickly accomplished as letting-down.

However, as the President shows, the Newcastle Company have done remarkably well in developing new business up to the time they dammed further accretion in the domestic line. Since 1909, the addition to the gas-cookers on hire has been 11,217, grillers 4150, and gas-fires 9499. This is remarkably good showing; but Newcastle offers an enormous field for further extension in heating business, notwithstanding the proximity to the coalfields. In fact, this proximity enforces the necessity for systematic and continuous procedure in development. Nothing better in the way of methodical working could have been adopted than to partition the supply area into four, with a district representative over each to conserve and develop business, and responsible to a competent chief of the Sales Department. While development in domestic conditions has been stopped, there is the conservation of present business and the development of the industrial load to keep the outdoor staffs going. The industrial part of the Company's business is, of course, a most important one, and the figures cited by Mr. Waddom accentuate this. A short time ago it was calculated that (exclusive of lighting in factories) the Company were selling annually some 750 million cubic feet of gas for industrial heating and power purposes, which figure (it is exceeded at the present time) represents nearly one-fourth of the total consumption.

Much was said in the address about the results that accrue to the industry from co-operative work and policy in commercial matters. The good that was done in connection with the coal question by united effort was also touched upon. Having got to a standard figure which the coalowners may charge above the 1914 contract pithead prices, Mr. Waddom thinks that we must look to the price so calculated for the period of the war, unless the operations of the Coal Export Regulation Committee succeed in bringing down the price to which the 4s. is to be added. The Act does not prohibit a change in price within the boundary line of the prescribed figure. But we do not think there is much hope of the colliery owners allowing anything to stand in the way of getting their full pound of flesh. It would be against all modern precedent of their own creating if they missed their opportunity. Speaking of the Coal Exports Committee, they also deal with coke and other fuel. The Newcastle Company have been for years developing a large overseas coke trade, and they have relieved the gas industry in the North of England by what they have done in this regard. In the last two years, 74 and 68·8 per cent. of the Company's coke production has been exported; and these percentages represent big total figures. Now if this coke export business is curtailed (and the Newcastle undertaking is only one out of several which export coke to the Continent) serious injury would be done to both the country and the gas industry, while freedom of coke exports to neutral countries would not do any good to our enemies. It is not our coke that Germany requires. It is our coal, and the products to be derived therefrom. So that it is hoped the Coal Exports Committee will look with a benevolent eye on coke. We do not think there need be any fear that the coke that remains with the coal production will not meet home requirements for fuel. There is a difference in coal stocks now compared with last winter. Speaking further of the primary residual, the President foresees a large development in its production through extended gas consumption, lower fuel accounts in manufacture, and, when oil is dear, the letting-down of carburetted water-gas plants. It behoves gas men, therefore, to exercise themselves in developing their local coke markets. What is being done in this regard in Newcastle, together with the results, is told in the address. An important factor in coke sales development is rapid delivery. This is being more and more recognized by gas undertakings. The horse and van constitute, according to our modern ideas, a cumbrous, slow-moving method. The Newcastle Company have a "fleet" of twelve motor waggons solely for coke transport. These extend the field for home sales; and rapidity gives to each waggon a large daily delivery capacity.

The address is just such a one as would be expected from Mr. Waddom—practical to the extreme, and full of sound directive wisdom.

Of Current and Future Concern.

The members of the Wales and Monmouthshire Institution did a right thing in not allowing the translation of Mr. A. W. Branson, from the Engineership of the Rhymney and Aber Valleys Gas and Water Company, to that of the West Hartlepool Company, to interfere with the tenancy by him of the presidential chair. If through the results of bombardment and various other pressing duties, he has not been able to give all the local attention that is expected from a President of a District Association, the address which he delivered to the members last Wednesday is one of those productions which amply make amends for any unavoidable presidential shortcomings. Mr. Branson surveyed the exceptional conditions arising from the war, in so far as they bear directly upon the gas industry. Every exceptional condition has its incidence in some form or other; but no President, in an address of this nature, can do more than deal with the conditions that have salient effects. Within the permissible limits, the President made excellent review—excellent in both its clearness and the philosophic reasoning for giving to the current conditions the broadest significance. There is greater safety in doing this than in the reverse, as the deficient interpretation of portents may land us in deeper quagmire than the industry's affairs are in at the present time through the circumstances of war, and nothing else. It behoves us all to be particularly open-eyed just now—not only in respect of the present, but of the future. In our considerations, the future is as important as is the present, because the future is not going to be exactly as the past. Those who to-day try to measure post-war conditions with the rule supplied by pre-war conditions, and accept the result, will indubitably find themselves in a grievous mess. We know fairly well where we stand at the moment; we know where we are for the time in regard to coal prices; we have fairly sound ground from which to make prospective count of residuals values—during the war, but not afterwards. It is now a question of looking forward.

There is a good deal of looking-forward in Mr. Branson's address. There is the immediately coming winter. He warns against deferring till Nov. 1 getting-in stocks, in order to obtain reduced prices under the Coal Prices (Limitation) Act—that is to say, in the case of those who made their contracts, during the period covered by the retrospective clause in the Act, at beyond the 4s. standard increase upon the pithead prices of the preceding year. Caution has come from high quarters against procrastination in the accumulation of stocks until the period when the demand will strain the output resources of the collieries, and possibly the capacity of the means of transport, which latter are beginning to feel the effects of the increased output and the transference of munitions. The necessities of gas undertakings that made high priced contracts during the period in question are, under the Act, a decided advantage to the colliery owners. This matter bears upon that of permanent increased provision for storage. This provision represents money; but it cannot be helped. The disparity in deliveries between winter and summer, the President urges, must be minimized in future as much as possible. This is wise. Those who are not troubling now about good stocks are menaced with a repetition of their trials of last winter and early spring. This may not prove so; but the menace bids fair to materialize. And after the war? Only the other day, it was seen that the scheme for a militant alliance between the miners, the railway, and the transport workers of the country is only being held in abeyance until the termination of war. Such a union is not a happy one for the peace of mind of the community at large.

The Coal Prices (Limitation) Act does not "establish the "principle" of coal price limitation; it is only a temporary instrument for keeping coal prices within defined bounds during, and for a period succeeding, the war, until we settle down again to something like normal conditions. But it is the thin end of the wedge in working for future control of coal prices, or, if not control, the setting-up of machinery whereby appeal can be entered when prices take unwarrantable flights. Mr. Branson thinks it only right (and we agree with him) that statutory concerns which are such large coal consumers as gas undertakings—especially in view of their limitations in respect of price and dividend—should have the power to appeal to some tribunal against "forced prices" for coal. The existence of such a power would undoubtedly be efficacious in moderating the profit-grabbing that has been witnessed on more than this one occasion during late years. Mr. Branson also touched upon the point as to the regulation of coke prices. The question, it may be recollected, was raised in the House of Commons by a coalowner when regulation of coal prices was under discussion. Retaliation was in the coalowner's mind; but the President of the Board of Trade reminded him of the fact that gas companies are limited in regard to gas prices, dividends, and finance generally, which the coalowners are not. Their positions are not by any means analogous.

In passing, Mr. Branson alluded to the proud position occupied by the gas industry in relation to the response made by its men to the call to arms; but he, too, thinks the time has come when the process of gradually stripping of men such a public service must be discontinued, if the public supply is not to be jeopardized. He is also of opinion that Government badges should now be provided for strictly indispensable men. Foreseen, too, is the compulsorily larger resort, in spite of the higher prices of both oil and coke, to carburetted water gas, owing to the fewness of men required in relation to output. Reflection leads to congratulation that, in these days of pressure for men, conditions are not as the old conditions were. Though the wages bills of gas concerns are larger than ever in normal times, through the increased demand for skilled workers in the distribution and sales departments, yet, owing to the introduction of labour-saving appliances (including carburetted water-gas plants) and higher yields per ton of coal, fewer men per million cubic feet of gas into the holder are required upon works to-day than was the case not many years ago. If there had not been the mechanical and other developments in all the manufacturing department that there have been the last decade or two, and the number of men required per unit of output had not been reduced, we hardly dare to think what would have been the position of the industry during this war.

Still looking to the future, the President sees in the position of the industry in respect of capital and dividends something that should claim the gravest consideration. We have hammered at this matter since October last year; and only last week again treated of the subject in connection with the terribly dwindling returns on some gas stocks, owing to the operation of the sliding-scale and heavy income-tax. All our restricting legislation in regard to finance has reference to normal times; and no one appears to have ever thought until this war of trying to make the rule of legislation subject to exceptional circumstances. In the case of sliding-scale companies, regulated price, dividend, carry-forward, and the means of raising capital, all help in these extreme times, supplemented by heavy taxation of dividends, to depreciate the capital position of the gas industry, and to give an unduly low return upon investments, just when the maintenance of income is very desirable to meet the more onerous needs. The proposal has been mooted in our columns that application should be made to Parliament to allow the temporary suspension of sliding-scale and auction clauses, and greater freedom in the issue of loan and redeemable stock. Though the gas industry has no equivalent in these matters among other industries of the land, the suggestion is met with a *non possumus*, and the question is asked why the gas ndustry should have preferential treatment over any other ndustry. The reply is because other industries are in a referable position in these times; and so the gas industry hould be divested of some of its curtailment, to enable it to ecure a nearer equality with those other industries—during xceptional conditions. The difference has illustration in ome dividends (less income-tax) and stock market values. Mr. Branson suggests that the matter should be dealt with y a General Bill; but the difficulty is to get people to move ointly in such affairs. Why, we cannot tell, because in this nstance it is only a matter of expediency to produce fairness —exercisable temporarily, and not permanently—and there-ore there need be no local opposition.

There are several other questions which have been raised y the war, to which the President turns attention. We cannot comment upon them all. There is, however, one re-erring to the charge for reduced public lighting. This has een a much debated matter. Mr. Branson thinks that, if n allowance is made for the gas unconsumed short of the ninimum stipulated in the agreement—such allowance to epresent as nearly as possible the actual saving effected by not having to manufacture the gas—then gas undertakings re doing all that should be expected of them, bearing in nind increased costs since the war began. The President loes not say whether he intends that the basis of deduction hould be the cost of manufacture to-day, or the cost prior o the war. If the current cost is taken, it seems to us he local authority would be getting an undue advantage wing solely to the war. We are glad to find the President uch a progressive that he believes in not allowing business evelopment to be stayed by the war within the limits of bility to prosecute the work, more especially seeing that resh business is required to compensate for lost consump-ion. There is full agreement, too, with him that insurance gainst bombardment and air-craft damage should be a ational burden, as being incidental to the war, not a burden n people who unfortunately for them are situated geogra-hically in the most pregnable positions.

Stepping aside from the war, Mr. Branson's experiences main-laying in a mining area will be found extremely nteresting, together with his advocacy of steel mains and ead wool joints. With regard to the point as to the reason hat the lead wool joint is more stable than the run lead oint, Mr. Walter Hole touched upon this in his American nstitute paper [see last week's issue]. He said that ex-eriments had convinced him that the lead wool joint is of nuch greater strength than run lead; but this is not due to he greater density of the lead wool packing. Experiments ave shown that the shrinkage of the lead ring towards the entre is one of the reasons for the essential inferiority of he run lead ring as a jointing material. Mr. Branson's ldress takes us over much ground, but in a concise way; nd there is interest in every part.

Calorific Value and Standard.

any case were required in defence of the substitution of a lorific value standard for the illuminating power one, as well s of the general lines and terms of the model calorific clause, would be found in the useful little paper that Mr. J. T. unn, D.Sc., read at the meeting of the North of England as Managers' Association on Saturday. It cannot be said at the paper presents anything new on the subject (the thor himself confessed as much); but its usefulness is und in the concise form in which are given the pertinent nsiderations affecting the matter, upon which even some en who profess technical knowledge of it have but hazy tions. Politely but effectively Mr. Dunn deals with those ho entertain the old, superficially based belief that calorific lue has some definite relationship with, or proportion to, uminating power. The latter is no direct measure of the ating or energy value of gas; for the small proportion of at that is given off by the burning gas does not by any eans represent the total heat energy of the gas. This ementary fact is too often overlooked. But we think at accumulating information, and published data, will adually extirpate the mistaken idea, from parting with hich there has been a good deal of reticence shown by rtain excellent engineers, but manifestly bad chemists and ysicists. Only recently tests have shown that if gas were actically denuded of its benzol, illuminating value would fall an amount unworthy the description, while the calorific lue would only be influenced by a comparatively insigni-ant percentage. The conclusion of Mr. Dunn is that the retention of such a purely formal requirement as illuminating power may seriously hamper gas undertakings in securing economic advantages in the process of gas manufacture. Discussing the Junkers and Boys calorimeters, he finds the latter the more convenient, and in ordinary daily work more accurate. Had Mr. Dunn been reading his paper before a meeting representing a body of gas consumers, it might by gas engineers have been regarded as an unkind thing to have "let the cat out of the bag" as to the influence of variations of barometrical pressure and of temperature upon the number of heat units delivered, per measured 1000 cubic feet, to the consumers through the differences in the volume of the gas. But on balance there is nothing much in the point. The instability of computations of net calorific values is again shown; and the case is made out for gross or total value in accordance with the model clause. There has been on various occasions discussion regarding the relative advantage and disadvantage of a gas of high and of moderate calorific value; and Mr. Dunn, like others in this country, but not consistently so in America, shows that advantage to the consumer, and to constancy and economy in manufacture, lies on the side of a gas of reasonably moderate value. There is no desire just now to enter into any controversy as to whether or not the metric system should supplement the established weights and measures in this country; but we are glad to find that the author supports the protest we made some time ago when, in certain calorific clauses, a hybrid terminology was adopted, and which protest, we are pleased to know, had weight with Mr. Charles Hunt, the Chairman of the South Suburban Gas Company, and led to all-British terminology in the calorific clause in the Company's Act of 1912. That clause really supplied the foundation for the one in the Gas Light and Coke Company's Act last year, and which revised form now (somewhat shortened) serves as the "model."

Colliery Owners and the Price Limitation Act.

Gas undertakings are having varied experience with colliery owners as to the construction of certain clauses in the Price of Coal (Limitation) Act. Some of the owners are trying to carry out the Act in the spirit and to the letter. Others are exercising the arts of evasion and finesse, in the attempt to get the better of those with whom they have contract business. Those who are doing this should be earmarked, and, through the private channels of communication which the Commercial Sections of the gas industry afford, promulgation should be made of their names. The last thing the gas industry desires to do, in present circumstances, is to quarrel with any of the colliery owners. All that the industry asks for is fair dealing. But the fact is, we learn from various parts of the country, that some colliery proprietors are contending that, under the new Act, the proper basis price is not the contract price for the year to June, 1914, but a day-to-day price. If such an interpretation were the true one, then the Act would be rendered practically nugatory, and the colliery owners so contending know this; for the necessary labour and investigation, and the certain dispute, would be so intolerable, and the beneficial result so limited by price variation up and down, that the primary objects of the Act—relief and control—would be almost completely extinguished. The submission of gas undertakings is, of course, that the price or prices paid under the corresponding contract for the year to June, 1914, is the correct basis. To heap up difficulty, and to make the Act as inoperative as possible, there are also colliery owners who assert that the 50 per cent. increase on waggon hire is chargeable on contracts entered into before the passing of the Act. This increase on waggon hire, certain colliery owners appear to regard as a helpful weapon with which to meet purchasers of coal who seek relief from new contract coal prices which exceed the terms of the Act.

Under these circumstances, the thanks of the gas industry are due to the Lancashire Commercial Section of the Manchester Institution of Gas Engineers for having obtained from the Board of Trade expressions of opinion as to the proper interpretation to be given to the clauses of the Act bearing upon these two points, and to the Board of Trade for permitting the publication of the opinions, which are given without prejudice to the view they might take under any special circumstances that might be referred to them by a Court of Law. The opinions are set out in two communications signed by Mr. W. F. Marwood, on behalf of the Board, and which communications are forwarded to us for publication [see "Correspondence" columns to-day] by Mr. S. Meunier, the Chairman of the Lancashire Section, and Mr. S. E. Halliwell, the Hon. Secretary. The opinions support the contentions of those responsible for the conduct of gas undertakings. "The corresponding price after the 29th of October," Mr. Marwood says, "will not be the price of coal sold otherwise than under contract, but will be the price of coal sold under a contract corresponding to that under which the deliveries are being made." Then as to waggon hire, Mr. Marwood states that, while the Board are not in a position to decide the legal question whether the giving of notice under section 4 (2) of the Act enables contractors to make increased charges for waggon hire, "they are of opinion that the giving of such notice would not appear to affect any terms of contract *other than the price of coal at the pits' mouth.*" These are the only intelligent constructions that could be placed upon the clauses in question; and we have little fear that neither before nor after the pronouncement of the Board of Trade, any colliery owner would have been or is prepared to take up in a Court of Law the defence of the position assumed by them or on their behalf. The decisions are valuable. In view of them, we hope much trouble will be averted. The Act having had its origin with the Board of Trade, the interpretation by the Board may be taken to represent the intention of the originators; and being called upon to construe, under ordinary contractual conditions, the meaning of the Act, a Court of Law would give heed to these stated intentions. It is to the interests of all concerned that the rebates to be made where they can be claimed under the terms laid down in the Act, should be settled as early as possible; and the publication of the correspondence with the Board of Trade should facilitate this being done.

Raids and Light Screening and Economy.

This coming winter will see further considerable reduction of consumption of gas and electricity for lighting purposes in the Metropolitan and certain other areas. Happy will be the gas undertakings in and about the Metropolis with a good heating, cooking, and industrial load; unhappy will be those electricity concerns with little more than a lighting load on their cables. The Home Secretary has issued a new order relating to lighting, not only in streets and open spaces, and inside and outside shops, but to domestic dwellings throughout the London Police District; and what is ordered for the Metropolis will undoubtedly be an exemplar for other localities more or less exposed to attentions by aërial raiders. The last Zeppelin raid on London will have prepared the citizens for a more stringent order; and what then happened will be the best possible inducement to ready compliance with the order, which is reproduced in its essential parts in our news columns to-day.

The first attempts made in London to obscure the streets from the inquisitive eyes of those running through trackless space above were not altogether satisfactory. They may have partially served their purpose; but the attempts and the effects looked painfully crude. High-power lamps in the streets had their globes painted at the top, with the result that the light from the lamps was not distributed; but huge circles of concentrated light were thrown on to the roadway below. We do not know what better indication than the occurrence of these equi-distant circles of light could have been given to nocturnal aviators that they were over a main street which, under ordinary conditions, was favoured with high-power lights. But this state of things is now altered; and a main street is given no more prominence than a side street so far as street lighting is concerned. Respecting shop lighting, considerable inconvenience is caused to shopkeepers in the matter of screening their inside lights; and it would do no one much harm, compared with present conditions, if, instead of putting tradesmen to all the trouble of keeping unlit or screening lamps, the fiat went forth that shops were to be closed at prescribed times during certain months. It is only because one shopkeeper will persist in keeping open after (say) seven o'clock that others in the same line of business are compelled to do likewise. If people, too, were informed that they could only shop in daylight hours as long as the war continued, they would soon get used to doing so, and arrange accordingly. It is because there is no compulsion that the tradesmen have to keep their shops open, and their assistants in attendance. We know day-by-day early closing is against the interests of gas consumption. But the interests of the country and of life have priority; and business in shop lighting has now got down to such lean dimensions, and will be leaner still in a short time, that little injury would be done to the gas and electric lighting businesses by the authorities going a step farther and compelling closing at specified hours in certain months so long as the war lasts.

An important step has been taken in including in the order referring to the Metropolitan Police District private dwelling-houses and other premises; and not only in respect of windows and glass-panelled doors facing the street but of back ones. It has in some residential areas been absurd to see the street-lamps with partly or wholly painted panes or globes, and the houses flanking the same streets with an unbroken run of lights showing brightly through diaphanous "blinds." This has been witnessed on both sides of streets and on upper and lower floors. All this is to be altered now, at both the fronts and backs of dwelling-houses and other premises. Everyone owes it to his or her neighbours, to the community generally, and to himself or herself, to see that the rules are complied with. Admittedly, there are difficulties; and no doubt recourse will be had to all sorts of crude devices for subduing the external indications of the presence of lights inside. Of course, the first thing will be to keep lights extinguished in all rooms not in use. The next thing must be to ensure, by heavy secondary curtains, or linings of some sort to the blinds, a less visibility of light. An alternative will be by screening lamps, and throwing the light downwards. There is room here, and an opportunity for the gas companies involved to show their interest, by sending round to householders a circular explaining to them how best to meet official requirements, and to do their part as citizens in this matter of helping to defeat one of the aims of the enemy. The enemy says that he looks for dark places in making raids; he would sooner have light places showing him something he may consider specially worthy of attention. If all places are kept dark, then he will not have the guidance of alternations of light and dark; and this will help to frustrate the success of his destructive mission.

The Old and the New.

The members of the North of England Gas Managers' Association visited Newcastle last Saturday, and had an excellent time in and about the Elswick Gas-Works, where the Engineer (Mr. T. Hardie) had much of very exceptional interest to show them. It is a works the equipment of which has been brought right up to date. There are large installations here of the Glover-West vertical retort system (which has displaced horizontal work); mechanical handling of material is the practice, including the telpher system; in the fine power house are seen three large gas-driven electricity-generating sets; and gas-compressors are in use. Everything, in fact, is as complete as engineering skill, ingenuity, and foresight could make it. In the description of the works (published in other columns), some comparative figures appear which show how the supplanting of old conditions has promoted economical working—the ground space required is less; the yield of gas and coke is more per ton of coal carbonized; a slight fraction less of tar is made per ton, but is compensated for by an increase of 0·79 lb. of sulphate of ammonia per ton of coal; and carbonizing wages are down to less than 25 per cent. of what they formerly were per 1000 cubic feet—viz., 4·91d. under the old system, as compared with 1·029d. under the new. Only a portion of the second installation of verticals has yet been put into operation; but the results promise to be even better than those shown in the tabular statement. The sulphate of ammonia produced per ton of coal is rather on the low side—19·79 lbs.; but perhaps there is some good explanation of this.

Silence and Reward in Dublin.

There is evidently no intention on the part of the Board of the Alliance and Dublin Consumers' Gas Company to allow the proprietors to see the report of the experts on the conditions of the concern, which were slowly robbing it of vitality and running it deeper into financial muddle. We still hold that the proprietors have a full right to have the report disclosed to them, so that they may judge for themselves to whom to award credit for what has occurred in bringing about the improvement, and from the same information be in the position to extract the causes for the deplorable state into which the concern was allowed to sink. There was absolute silence regarding the report at the meeting of the proprietors on Thursday last; but the attendance of shareholders was very small. At this small meeting, the resolution was passed awarding the three new English Directors an extra tangible recognition of their services to the tune of £1000, and allowing them to be specially interested in the division of a further £500 per annum voted as Directors' fees. Mr. Roche, who moved the necessary resolution, gave to the Directors from England credit for having "placed the concern in a position which the proprietors had not looked to see it in in so short a time." Are they the only ones who have worked to that end? If so, then the quicker the other Directors are ordered by the proprietors to right about face, the better. But Mr. Roche also acknowledged in words the efforts of the officials, including Mr. W. J. Grey (the Secretary), as well as the efficiency with which the work of all departments is now being carried on. The Chairman (Mr. John Murphy) likewise acknowledged—in words—how much is due to the Consulting Engineer (Mr. William Newbigging), whose "efforts in placing the works on their proper basis had been unremitting and, he was glad to say, uniformly successful." He also referred to the "able services" rendered by the Secretary and the Works Manager (Mr. H. Dumbleton) in their respective capacities. The £1000 and the £500 a year ought, it seems to us, to have a wider distribution. Mr. Roche further urged that the duty of the proprietors was to encourage the Board in the enterprising methods which had been adopted. A question that concerns the proprietors is, Who proposed these enterprising methods? And a further inquiry, Was the concern really allowed to run into an unsatisfactory and perilous condition because the proprietors had not previously sufficiently "encouraged," the Board? Ireland must be sadly off for gas directors if it is necessary to cross to England for men to fill such positions who have not been technically trained in gas matters and administration, to pull a Company out of difficulty into which it had been muddled. One indication is given as to the direction from which good has been derived by the Chairman's references to economies effected, through technical advice, in coal handling and other matters. The new Directors surely did not suggest these economies. Need more be said?

Income-Tax Deductions.

In our "Miscellaneous News" columns to-day, there appears the text of a memorandum, issued by the Board of Inland Revenue, as to the deduction (under the new order of things) of income-tax from interest and dividend payments made after to-day. There would be little use is pointing to the main features of the document; it requires to be studied in detail by secretaries and others who will have to deal with the matter.

Enlistment and Badges.

Among the minutes of the last meeting of the Council of the Institution of Gas Engineers (published in a subsequent column) is one stating that the Manchester District Institution have obtained from the War Office an assurance that skilled employees of gas undertakings are not to be accepted for enlistment unless in possession of a certificate from their employers showing that their services can be spared. The Ministry of Munitions state that the wearing of the official badge will exempt men from enlistment.

Flues, not Chimneys, for Gas-Fires.

The "Builder" has done a service in showing how the gas-fire can assist in modifying building designs and economizing in space and structure. Just recently, the electricians have been endeavouring to make the point that in box-like bed-rooms in flats, there is no need with electric-radiators for chimneys; but the trouble they cannot get over is that the exclusion of a chimney from a bedroom affects ventilation in a very ugly and insanitary way. 'Not all architects who may happen to prefer electric lighting are prepared to advise the abandonment in bedrooms of a chimney of some kind. But in a "Builder" article [extracts from which are given elsewhere], it is shown that the gas-fire can be of assistance to the architect in diminishing chimney structure for any rooms, and yet maintaining a ventilating shaft, and at the same time securing the aid of a gas-fire in promoting ventilation. A flue of an area of only 36 square inches amply suffices for a gas-fire; and, as no sooty incrustations occur, the chimney area will always be maintained. Besides economy in space and structural work, there is the saving effected by not having to put in coal-grates, which often represent such waste of money in these days when people like the freedom from labour, the convenience, and the heating efficiency of the gas-fire. Some illustrations are given in the article of places that are now innocent of the crude system of heating by coal; and a hospital is mentioned that has shallow flues let in the walls for gas-fires, in order to save space.

PERSONAL.

A proposal has been made for the erection of a memorial tablet in the Municipal Buildings, Blackrock, to Lieut. NESBITT, of the 6th Battalion Dublin Fusiliers, and well-known prior to his enlistment as an official of the Alliance and Dublin Consumers' Gas Company, who was recently killed in action.

The accountantship of the Gas Light and Coke Company—vacant by the death of Mr. Blakey, recently recorded in our pages—has been filled by the appointment of Mr. H. E. IBBS. According to the Company's "Co-Partners' Magazine," he is a son of one of the Company's collectors, now on the pension list. He entered the service as a junior clerk in the year 1899, and became a senior clerk in 1907. This year, on it becoming unfortunately apparent that Mr. Blakey's absence on sick-leave was likely to be prolonged, the Court of Directors appointed Mr. Ibbs as Acting Accountant *pro tem.*

We learn from Mr. Ernest L. Burton, the Secretary of the Brighton and Hove General Gas Company, that the following changes have taken place in the staff of the Company: Mr. JOSEPH CASH, M.Inst.C.E., has retired from the position of Engineer and General Manager of the Company, and has been appointed a member of the Board. Mr. Cash has been identified with the Company for the last fifty-four years. Mr. CHARLES H. RUTTER, M.Inst.C.E., the Assistant-Engineer of the Company, has succeeded Mr. Cash as Engineer and General Manager. Mr. Rutter was first associated with the Company in 1886. To fill the vacancy created by Mr. Rutter's promotion, the Directors have appointed, as Assistant-Engineer, Mr. F. SMALLBONE, who was for many years Engineer and Manager of the Chigwell, Woodford, and Loughton Gas Company.

OBITUARY.

The death of Mr. E. H. MILLARD, the Gas Manager to the Cowes Urban District Council, occurred on Monday last week under circumstances of great suddenness, which are recounted on another page of this issue. Mr. Millard had been for thirteen years in charge of the Cowes gas undertaking, in connection with which he had done much good work. He was 54 years of age, and a native of Middlesbrough. Before going to Cowes, he was Manager of the Hinckley Gas-Works, and for about ten years he managed the Durham Gas-Works. Deceased was a member of a Durham Lodge of Freemasons. He leaves a widow and eight in family—the majority grown up. The funeral took place on Thursday, and was attended by the Chairman (Mr. Douglas Atkey), members, and officials of the Cowes District Council, employees at the gas-works, and a number of local gas managers. Among the floral tokens, was one inscribed "In faithful remembrance of their esteemed Secretary, from all the members of the Isle of Wight Gas Association."

Midland Association of Gas Engineers and Managers.—The autumn meeting of this Association will be held at the Grand Hotel, Birmingham, on Thursday afternoon of next week.

Manchester District Institution of Gas Engineers.—Under the presidency of Mr. J. G. Newbigging, M.Inst.C.E., the 173rd quarterly meeting of the Manchester Institution will be held on Saturday, the 30th inst., at the Grand Hotel, Manchester, after a morning visit to the Bradford Road Gas-Works, to inspect the toluol extraction plant, the chemical-works, and other interesting developments now being carried out at this station. The principal business in the afternoon will be the reading of a paper by Mr. E. V. Chambers (Messrs. Hird, Chambers, and Hammond), on the "Dehydration of Tar," and an informal discussion on toluol extraction. Thereafter, a report from the Scrutineers will give the result of the election of office-bearers for next year.

Coke-Oven Gas Distribution in Germany.—The distribution of coke-oven gas for light and heat was (says "Engineering") introduced in Germany years after it had gained a footing in the United States; but in the former country it had assumed considerable importance by the end of 1913, when about [illegible] per cent. of the total gas consumed was coke-oven gas. The start was made in Westphalia. The two most important plants are that of the Hamborn Colliery, which sends coke-oven gas by lines about thirty miles long to Barmen and to Wessel, the mains having a diameter of about 20 inches, and that of the Rheinische Elektrizitatswerke, which sends the gas from the Mathias Stinnes collieries to several municipalities through a pipe system 140 km. in length. These two pipe systems are interconnected to meet emergency cases. Fifty municipalities in Westphalia and Rhineland burn coke-oven gas, which is also much used in the Saar district and in Lower Silesia. The price varies (or varied before the war) very considerably, the minimum being 1·5 pf. per cubic metre = 5d. per 1000 cubic feet.

INSTITUTION OF GAS ENGINEERS.

War Office and Recruiting—Scientific and Industrial Research.

A Meeting of the Council of the Institution of Gas Engineers was held at the office, No. 39, Victoria Street, Westminster, on Wednesday last—Mr. John Young, the President, in the chair.

The deaths of the following were reported, and the sympathy of the Council with those who had been bereaved was recorded: Mr. Joseph Hepworth, of Edinburgh, Honorary Member; Mr. Edward Allen, of Liverpool, Mr. Thomas Bower, of West Hartlepool, and Mr. Adam MacPherson, of Edinburgh, Members. With regard to the death of Mr. Allen, expressions of regret at his loss were received from the Société Technique de l'Industrie du Gaz en France and the Council of the University of Leeds. To fill the vacancies thereby caused, the following appointments were made: The President to serve on the Advisory Committee on the Livesey Professorship at Leeds University; Mr. John Bond, to serve on the Corbet Woodall Scholarship Advisory Committee; and Mr. Jacques Abady, to serve on the National Illumination Committee of Great Britain.

Mr. John Bond was appointed as successor to the vacancy on the Committee of Management of the Benevolent Fund caused by the election of Mr. Young as President of the Institution.

It was reported that Mr. J. B. Scott, of Cowdenbeath, had been appointed District Member of Council to represent the North British Association of Gas Managers; and Mr. W. Doig Gibb, the Southern District Association of Gas Engineers and Managers, for the year 1915-16.

The report was presented of further action taken since the last meeting with respect to the shortage of coal supplies, leading to the passing of the Price of Coal (Limitation) Act.

With reference to the Institution certificate for gas-fitters, it was decided, having regard to circumstances occasioned by the war, to extend the period of issue to two years after the conclusion of hostilities. It was decided to extend the Institution certificate to gas-fitters above twenty-five years of age, and of five years practical experience who have passed first-class in the final grade in the "Gas Supply" examination of the City and Guilds of London Institute, in 1915 and previous thereto. Applications for the certificates are to be made through the District Gas Associations within two years of the conclusion of the war.

Applications for the Institution certificates to gas-fitters were approved and certificates ordered to be issued in 44 cases.

The Sub-Committee on the Life of Gas-Meters Inquiry reported that progress had been made with the preliminary work of the investigation.

A communication was received from the Manchester District Institution of Gas Engineers stating that they had laid before the War Office and the Ministry of Munitions the serious depletion of men from gas-works which was taking place. An assurance was received from the War Office that skilled employees of gas undertakings are not to be accepted for enlistment unless they are in possession of a certificate from their employers that they can be spared; and from the Ministry of Munitions, that the wearing of the official badge would exempt the workman from enlistment.

It was announced that, in response to a request from the Royal Society, the names of members of the Institution on active service had been sent, for inclusion in the "War Service Register of Scientific and Technical Men in His Majesty's Forces."

Applications for membership were considered. The following names were approved for inserting in the next ballot-list: For the class of member: Mr. Frederic Chadderton, of Barrow-in-Furness; Mr. Barton Grainger, of Rhymney; and Mr. Glanville Dennis Stone, of Wanganui, New Zealand. For the class of Associate Member: Mr. Stanley Alfred Bevington, of Woolwich; and Mr. George Charles Pearson, of Birmingham. Mr. Robert Burr, of Chester, was admitted as a Student of the Institution.

A report was made of an application to, and an interview with representatives of, the "Advisory Council of the Committee of the Privy Council for Scientific and Industrial Research," on the subject of financial assistance for the various researches being undertaken by the Institution. The Advisory Council asked for particulars of these researches, and their estimated cost. It was decided to supply the information with the hope that funds would be granted to assist the work which the Institution are engaged upon and have in view. The matter was referred to a Committee consisting of the following: Mr. John Young, Mr. A. E. Broadberry, Professor John W. Cobb, Dr. Harold G. Colman, Mr. Samuel Glover, Dr. J. W. Mellor, and Mr. W. E. Price.

The resignation of Mr. Ernest Scears as Abstractor for the "Transactions" was received with regret, and a vote of thanks was passed to him for his services.

Reports of the Emergency Committee, the Publications Committee, and the Finance Committee were presented and adopted.

Coal Distillation and Bye-Products.—A book bearing this title is to hand from Messrs. Thomas Wall and Sons, Limited; the author of it being Mr. J. E. Christopher, of the Wigan Coal and Iron Company. It consists of 90 pages, including 41 illustrations and diagrams. A review of the contents will be given in a subsequent issue of the "Journal." The published price is 2s. 6d.

FRANKFORT-ON-MAINE GAS COMPANY.

Transfer to the Corporation.

The "Frankfurter *Zeitung*" of the 31st of August last stated that the Frankfort Corporation had acquired, by friendly negotiations, the greater part of the shares of the Frankfort Gas Company, and consequently the latter has become almost a purely municipal undertaking. The statement proceeds as follows.

The Frankfort Chamber of Deputies, in a private session on the 1st of June last, dealt with the matter, and arrived at the following decisions.

1. The Chamber of Deputies empowers the City Council: (*a*) To accept the offer of the Imperial Continental Gas Association, of the 19th of May, 1915, *re* the sale of 7705 shares in the Frankfort Gas Company, and *re* the transfer to the city of a bank claim against the Frankfort Gas Company for 3,150,000 marks [about £154,400] on the conditions embodied in the Association's written offer; (*b*) To issue a loan for a maximum of 20 million marks [about £980,000], bearing interest not exceeding 5 per cent., to cover the obligations arising from the purchase of the 7705 shares of the Frankfort Gas Company, and other obligations from the acceptance of the offer of the 19th of May, 1915, and to arrange with the Financial Control Committee the terms for the redemption of the loan.
2. The Chamber requests the City Council to at once secure the assent of the Finance Control Committee to the loan.
3. The Chamber expects that when the city has obtained control of the bulk of the share capital of the Frankfort Gas Company, representatives of the town, in addition to members of the City Council, will have seats on the Board of the Company.

The share capital of the Frankfort Gas Company amounts to 13,600,000 marks, of which the city held 3,000,000 marks, according to the terms of the concession of 1909. The city has also acquired shares for about 150,000 marks from private holders; and with the 7705 shares now being acquired, it will possess altogether about 10,855,000 marks of the share capital of the Company. The 3,000,000 marks of shares were allotted at 105 per cent.; but for the 7705 shares now acquired 198 per cent. is to be paid. The shares are to be transferred as from the 1st of April last. They are to remain for the present in the custody of the Berlin bank in which they had been deposited by the former proprietors. The purchase price is to be paid six months after the conclusion of peace. The dividend for 1914, which will amount to at least 10 per cent., goes to the former proprietors.

The city has also to take over a debt of 3,150,000 marks to the Berlin bankers, Messrs. Delbrück, Schickler, and Co., with whom the shares had been deposited as security, and to repay it when the purchase price of the shares becomes due. This is the balance of a loan granted to the Frankfort Gas Company for the construction of the new gas-works in the Schielestrasse, which was repayable in ten annual instalments, with interest at 5¼ per cent. The city now cancels the debt, and takes the place of the former creditors.

* * *

GAS AND HYGIENE.

During this week—that is to say, the opening ceremony took place yesterday afternoon, and Saturday will be the closing day—there is being held, at the Institute of Hygiene, a Lighting, Heating, and Cooking Exhibition, from which it is certain that much good will result. The reason why this assertion may be made with confidence is, in the first place, the excellent manner in which things have been arranged. Then there is the attractive series of lectures and demonstrations which is to be given; and, thirdly, there is the situation of the display—in the heart of the West-end of London, and in the very home of the medical profession. In doing good, the exhibition will, after all, achieve its purpose; for it is intended as an educative display in connection with the objects of the Institute of Hygiene, whose efforts are devoted to the furtherance of "all that pertains to a healthy life and a healthy home." During the next few days, many people will visit Nos. 33 and 34, Devonshire Street, Harley Street, W., and if they are attentive and observant, they will gather much useful information.

Look for a moment at the programme, by which the justification for this remark can, at any rate in part, be tested. There is a series of four lectures—each on a topic which closely concerns everybody, and each by an acknowledged authority on the subject dealt with. This afternoon, the question of "Domestic Heating," from the point of view of economy and comfort in the home, will be the title of a lecture by Mrs. Cloudesley Brereton; while the three following afternoons will be equally well filled by Dr. R. King Brown, who will speak on "Heating and Health," Mr. Leon Gaster on the "Use and Abuse of Light," and Mr. Herman Senn on "Economy in Cooking." All the lectures, it may be pointed out for the benefit of intending visitors, are arranged to begin at half-past three. In addition, there will be demonstrations in cooking each day during the week. Yesterday was devoted to

English, Scotch, and Irish dishes; while to-day and to-morrow French and Russian dishes will be shown in the making. After this, it will be the turn of the Italians and the Belgians—German dishes, it is hardly necessary to say, do not find a place on the list. Saturday has been set aside for popular economical dishes. Students will also be able to get some hints on invalid cookery, and also learn the secrets of bread and cake making—perhaps of more importance now than usual, when affairs have reached a critical stage with so many household budgets.

As has been indicated, there will, from the hygienic point of view, be much that is of vital importance to be learnt from what will be told and done at the exhibition; and the same may be said of what is to be seen. Heating is exemplified—and no other method so good could have been chosen—by a representative display of the latest designs of gas-fires by well-known makers, some of which have been described in our pages within recent weeks. A particularly striking exhibit in this connection, which deserves special mention, is a set of four fires, in armour bright, arranged in a row, with a metal surround to match. There are also radiators, and various water-heaters, including a "Victor" boiler installation, connected-up, with towel-dryer and bath supply. A useful appliance for hospital work is a gas instrument sterilizer. With the small burner which is all that is required, the consumption of gas is infinitesimal; and when connected by a flexible tube to a gas-point, and placed on a glass table fitted with castors, it can be wheeled in a moment to any desired part of the ward, thus frequently saving a good deal of time and trouble.

The most economical and most convenient method of cooking is adopted for the demonstrations—namely, gas—and in addition to cookers actually in use, visitor sare able to inspect other patterns designed to meet both large and small requirements. The lighting, too, leaves nothing to be desired, consisting, as it does, for the main lights, of Sugg three-burner lamps fitted with handsome Holophane globes. Each lamp is individually controlled, and is fitted with a permanent bye-pass on a separate service, and a mercurial seal.

GLOVER-WEST VERTICAL RETORTS.

A Volume Descriptive of Detail, Operation, and Results.

From West's Gas Improvement Company, Limited, of Miles Platting, Manchester, there has been received a new edition of their book descriptive of the Glover-West vertical retort system. The new volume excels anything that the firm have hitherto attempted in this line—so that it would be unjust to treat it as an ordinary manufacturers' catalogue. It is something much beyond this. It is a technical work that is worth having, and worth preserving in the library of any gas engineer; for in it the whole of the system is exposed in every detail and feature from retort-house foundations through to the plant for handling coke. Nothing is missing. It is in reality a digest of a large experience with the system—the system unaltered in its first principles, but showing at this part and that part the improvement in detail effected by experience, and which improvement has enabled continuous carbonization to be applied to small works as well as to large and intervening ones.

There is an explanatory introduction, which is something more than a preface, and should be read. The considerations are here marshalled which must be deliberated upon in determining as to the setting and auxiliary plant to be adopted. One learns as to how rapidly the system has developed, so much so that the firm can now count 75 installations in being or close upon finished in different parts of the world; and if reference be made to pages at the end of the book, the daily capacities of these various plants—large and small—are seen set forth in cubic feet or cubic metres. Looking at the figures, it is not surprising that the firm have had to largely extend their works in order to deal with the demand for the Glover-West continuous carbonization plant, with the auxiliary plant for handling material. The considerations in favour of continuous carbonization are also presented. We will not run over them here. But this is a case where one has to take into account result and the liberty that a system gives in deciding comparatively what a new plant will do. Result is largely purchased by initial cost; but some engineers get no further than a little rumination upon the tons of coal carbonized in relation to initial cost, which tons of coals are really only the half-way house in consideration. The volume is the place where can be seen what the firm have to say on the subject. But let us point to certain salient features: There is the economy of labour in and about the carbonizing plant, which economy is an essential more than ever to-day, when the distribution department claims so much, and yet labour for both works and outside district is so difficult to obtain to comply with maximum need. There is the flexibility of the continuous system—a flexibility obtained by means of the regulation provided, and which enables one to deal with any class of coals, and—by fast or slow working, or high or low temperature carbonization—obtain variations in quantities and qualities of products primary and secondary. It matters not to the contractors what an engineer's desires are in these matters; they place in his hands plant having the capacity for obtaining what he requires. There is the low fuel consumption, which condition is largely subscribed to by the recovery of heat from the spent charges (thus cooling them) before leaving the section of retort below the carbonizing region. Then there is constancy (given, of course, regularity of working and sameness of coal) of illuminating power and calorific value of the gas.

The descriptive work, treating of the main plant and the auxiliary plant, in the volume is well done; and any engineer reading it could from the volume draw up, without going into minor details, a fairly good specification of requirements under his own conditions. There are standard principles in the system; but the plant is seen to be adaptable to all works' circumstances. The illustrations which aid the descriptive work include about seventy reproductions—most of them in several colours, and veritable works of art. Only a few of them are black and white; and these mostly concerning detail. The book is printed on art paper, so that the details of the illustrations have excellent emphasis. Succeeding, are set out in every particular the results of tests of many varieties of coal by independent men who are not in the habit of appending their names to data for which they cannot personally vouch. Calorific and illuminating power charts are included. What the engineer will also find of considerable value is a good index, reference to which will enable him to quickly transfer his attention to any point upon which he requires information. The book is bound in cloth. In fact, externally and internally West's Gas Improvement Company have endeavoured to get as far away as possible from that appearance and general character which spells "catalogue" without the word actually being printed. They have given a technical work on the Glover-West system as designed and operated in this ever-memorable year 1915, and which work the engineer will find will not disgrace, but will add to the value of, the contents of his bookcase.

We have given this extended notice of the book because the firm have in it made a definite departure in adding to the value of the literature from the manufacturers' works. It may be argued that this is scarcely the time to send out a volume of this description. We think otherwise. In the first place, the war has no doubt given the firm opportunities in their offices of getting the work done which they might not have later on through pressure of other matters. In the second place, engineers will be considering *now* their plans as to the work that will be necessary at the conclusion of the war, and the firm want to submit to them the argument in favour of the Glover-West system. The volume, therefore, in our opinion, is quite opportune.

WAR LIGHTING IN GERMANY.

[Communicated.]

There was published in the German newspapers in the second half of September a semi-official announcement which refers to the question of the use of artificial illuminating agencies in the immediate future. It states, in the first place, that, notwithstanding all the efforts put forth, it will only be possible partly to meet the requirements of the civil population in the matter of petroleum during the autumn and approaching winter. The Imperial and Federal state authorities have, therefore, endeavoured for some time past to pay attention to the problem of lighting substitutes. In many places since the beginning of the war electric or gas lighting has taken the place of the former petroleum lighting. Where according to local conditions this has not been possible, acetylene or spirit lighting will come chiefly into consideration to replace oil during the coming winter.

The requisite supply of carbide for acetylene lighting, the statement continues, will only be available, however, in moderate quantities in the winter, as the carbide works are contractually bound to deliver the carbide for the most part for conversion into cyanamide products. Having regard to the great requirements in cyanamide for agricultural purposes, scruples exist against the prejudicing of the production of this material by the employment of large quantities of carbide for acetylene gas lighting, although the announcement naturally refrains from mentioning that the cyanamide is also needed for the extraction of nitrate for explosives. Moreover, a number of defects are associated with acetylene lighting on a small scale [table lamps] owing to unsuitable construction, careless finishing, or inappropriate handling of the lamps; so that for these reasons the authorities abstain from urging the further use of this method of lighting. Apart from this fact, makers on their own initiative have constructed large quantities of acetylene lamps.

A substitute for petroleum lighting of almost equivalent value, although slightly more costly, is afforded by the use of spirit lighting. The principal difficulty—the provision of a sufficient number of the burners which have hitherto all been made of copper or brass—has been overcome by the makers by the construction of a burner of faultless quality without the use either of copper or brass. Accordingly, as through the adoption of suitable measures by the authorities the availability of adequate quantities of spirit has been assured, a working company [the Spirit Incandescent Warlight Company] in Berlin has recently been formed with the co-operation and under the supervision of the Imperial and Federal state authorities, for the purpose of supplying Germany with lamps for spirit incandescent lighting, and particularly the sale of spirit burners for lighting on a small scale. The company will offer this new burner together with wick under the title of the "Warlight" [Kriegslicht] at the retail price of 4s. This amount, however, does not include the price of the accessory parts, such as the mantle, glass chimney, can to fill the lamp, &c., the cost of which is 1s. 3d. in addition.

In order to promote the introduction of the new burners as much as possible, the State and Communal authorities have been induced to collect orders for the burners, and transmit them to the Warlight Company. The authorities and the communes will receive the burners, which were to have been ready for the market in the third week in September, at a preferential price on condition that they dispose of them to the population at 4s. each. This obligation has been imposed in order to exclude the wholesale and retail trade. On the other hand, the authorities and the communes, through securing the burners at a cheaper purchase price, are to facilitate the obtaining of burners by the poorer population, either by disposing of the burners at less than 4s. each or by letting them out at a rental or by selling on the system of payment by instalments. Any losses can be equalized by the profit realized on the sale of the remainder of the burners.

The official announcement proceeds to state that the new burners can be screwed on to any petroleum lamp. In most cases a filling piece, having a suitable screw-thread connecting between the lamp reservoir and the burner, must be used; but this is not requisite when the reservoir is fitted with a filling screw device for the pouring-in of the lighting agency. A small filling can is used for the supply of the amount of spirit necessary for the warming of the burner—the can only allowing to pass out the particular quantity of spirit required for this purpose.

It is essential that the mantles and glass chimneys should be of good quality; and for this reason the Warlight Company will impose upon retailers who sell the burners the obligation to equip the latter only with mantles and chimneys made by particular factories. As the conversion of existing petroleum lamps into spirit lamps presupposes certain expert knowledge, it is recommended that this work should be entrusted to the retailers from whom the burners are purchased. The retailers will be bound to adhere to the uniform price of 4s. per burner, as well as to the prices fixed for the accessories, the quality of which is to be guaranteed.

The new burners yield a lighting power of 50 hefner candles, as compared with 18 candles of the No. 14 petroleum burner; and the consumption of spirit amounts to about one-twelfth of a litre (0·146 pint) per hour. Thus, at the present price of spirit, the cost works out at ⅝d. per lighting hour. But a reduction in the existing price of spirit is said to be out of the question.

If the brightness of the light should dimish after a long period of lighting, it is sufficient as a rule to clean the lamp and renew the wick, at the price of 3d., in order to restore the lighting to its former condition—the cleaning being entrusted preferably to the retailer. The burner makers would be able to meet the requirements for the construction of spirit lamps giving less light (about 30 candles) or greater light—up to 100 candles—by making alterations in the 50-candle power burner. The former would have the advantage of a lower consumption of spirit. But the price of the burner could not be reduced; and the company proposes for the time being only to make the normal burners.

It is added that spirit lighting, on account of the use of incandescent mantles, is not suitable for those cases in which the lamp would be especially subject to shocks or strong wind. In these instances—such as for market stalls and for cart lamps—acetylene is more appropriate. On the other hand, spirit incandescent lighting is declared to be greatly preferable to acetylene for internal illumination. It is understood that the public authorities intend to substitute spirit for petroleum wherever the latter has hitherto been employed in their departments. It is further suggested by the Imperial authorities that when the lighting requirements can be only partly met, large halls in schools or other large buildings should be placed at the disposal of the population—particularly for the purpose of enabling home workers to continue their activity during the period of dark days. The great lighting power of spirit incandescent lamps is stated to be specially suitable for the lighting of such workrooms.

Coke in Gas-Producers.—Dr. H. Margraf states in a German paper that some difficulty exists in that country in getting the required amounts of gas-producer coal; much more being coked than formerly, to secure the coveted bye-products. This has resulted in constant effort to get coal replaced as far as possible by coke. Many boiler plants already employ coke firing with good success; and recently experiments have been made in ordinary gas-producer practice. At a plant in Lorraine, coke mixed with coal has been used since the beginning of January with complete satisfaction in the heating furnaces for the rolling mills. No changes in the producers were necessary. The work of poking is somewhat less than when coal is used alone. The coke settles down uniformly, and does not form hollow places; for it does not swell and become soft when heated, like coal. The ash removal offers no difficulties; and the coke contains practically no volatile matter, so that no heat is taken up for distillation. The producer therefore showed a tendency to run hot, and it was found that about 10 per cent. more steam than usual had to be mixed with the air. The producers were found to gasify the same amounts of material as formerly. There are at present no exact results as to the comparison of the two materials for gas-producer work; but from a theoretical standpoint, the coke would appear to be the best. It is believed that the gas burns with a shorter, sharp flame; but this is not the case. In the heating furnaces, it shows an extremely long flame, somewhat more transparent than the ordinary flame, but clearly seen.

ELECTRICITY SUPPLY MEMORANDA.

Hypocrisy Illustrated.

We do not know it is much use inviting our electrical friends to bestow sensible consideration upon the report of Lieut.-Col. Druitt on the terrible railway disaster at Gretna, and not to give way to silly partizan notions, generated by purely commercial rivalry. "Meteor" of the "Electrical Times" did, on the publication of the report, again draw from stock some of the worn arguments based on fallacy; and he pleads for prompt official intervention, obviously for the purpose of placing in the hands of electrical contractors the work of fitting-up trains with electric light, in place of gas light. He does this without having in his possession anything but some vague idea that gas does contribute to railway train fires, and the recommendations of Board of Trade Inspectors, who have never yet investigated the subject to see whether there is any technical justification for the judgment they have formed. Their recommendations are all founded on pure hypothesis. The Gretna railway disaster was one of the very gravest on record. In it three trains, with four engines, were massed in confused wreckage, with death, maiming, and destruction the horrible accompaniments. But with it all—though of the total number eighteen coaches were gas lighted and fifteen electrically lighted—Lieut.-Col. Druitt has to report that there is no doubt the fires were caused by the engines, though he fancies (he has no evidence to show it was so) gas may temporarily have contributed to the intensity of the fire. There is joy in the electrical camp over this small piece of vagueness; anything, however scrappy and unsubstantial, seems to serve the electricians. So, again, we have the prayer for official compulsion in effecting change. The hurling of hundreds of poor fellows into eternity through a colliery explosion caused by electrical sparking or short-circuit has no effect on these men; nor has the sacrifice of human lives in factories through electrical operation that Mr. Scott Ram annually reports to the Home Office. These men can be callous and blind to these things when their own interests are concerned; but when, on the lamest pretext, gas can be assailed, hands are held up in pious horror, and the scream for Government intervention is at once heard. Hypocrisy surely never had better illustration.

Cause and Effect.

In view of the terrible nature of this catastrophe, and the evidence as to the cause of the fire amid the wreckage, why did Lieut.-Col. Druitt go out of his way to reiterate the old desire for the consummation of the whim for the eviction of gas from railway trains and the installation of electricity? Not long since an expert on lighting, though with electrical preferences, showed very conclusively that there were practical reasons why such a change was not the simple matter imagined by some people with superficial knowledge. If there is one lesson about this accident which stands out clearly above all others in connection with the matter under consideration, it is that, if all that has been said derogatory of gas lighting in trains were true, this accident ought to have intensified many times the misdeeds of gas. But it has not. It illustrates how conceptions and conclusions can be misderived. With some people of shallow perception, gas must be at the bottom of the mischief because it is present. It must be the cause of fire, and of explosions. But here we have only one brakesman who "remembers" seeing a tongue of fire about two yards high, and who "thinks" the tongue was due to burning gas on top of the wreckage *just about where the engine of his train was lying.* What a pretty lesson in deduction from the obvious premises. This man had not been trained, and his own qualifications did not enable him, to make observation of cause and effect. An engine the cause; a tongue of flame from gas the effect! "Meteor" quoted, with relish, and apparently accepted as conclusive, this sapient instance of ripe and sharp intelligence. Then an engine-driver asserted that, while he was engaged in trying to extinguish the fire, there was an explosion, and pieces of metal about the size of his hand rose out of the wreckage, which he ascertained to have come from the gas-tanks. How he did this does not appear to have been the subject of inquiry. Some witnesses spoke to hearing explosions; and some did not hear anything of the kind, which conflicting testimony shows how untrustworthy is evidence drawn from a scene of such wild and fearful excitement. George Hutchinson, a fireman, spoke to hearing two or three explosions from among the *débris* near the engine of his train; the noise sounding like a gun going off. James Benson, a driver, noticed one or two severe explosions; but he did not see anything in the nature of a sheet of flame as from gas. John Cowper, a driver, heard repeated explosions. Another driver, Andrew Johnstone, was blown off his footplate by an explosion; but he could not say whether it was due to the gas-tanks or to ammunition. He did not observe any sheet of flame; but he heard several explosions after the one that blew him off his footplate. We are here getting in the vicinity of an alternative to gas. A guard, Douglas Graham, had not time to get his red flag and detonators. Lieutenant J. C. Bell stated that, so far as he knew, there was no loose ammunition in the train; but he thinks some of the boxes of ammunition must have been broken, as he saw some lying about afterwards. This evidence seems to clear up the real cause of the explosions heard. But Lieut.-Col. Druitt makes a very interesting remark. He says that a "large number" (remember eighteen of the total number of coaches were gas lighted, and the remainder electrically lighted) of the gas cylinders in the vehicles were very badly damaged—several of them being torn open, while others bore "traces" of having been ruptured by the excessive pressure of gas caused by the intense heat. It would have been very instructive had Lieut.-Col. Druitt dilated further on this question of the pressure needed to rupture steel vessels by heat generated under such conditions.

Findings and Recommendations.

We make out that nine of the witnesses testified to the fact that the four engines involved, with wreckage piled up about and over them, were the centre of the fire that raged. Lieut.-Col. Druitt says a fire under the conditions was "inevitable." This would be fairly plain to any one of ordinary intelligence reading all the evidence without prejudiced eye. He considers that the outbreak on the main part of the wreckage was due to live coals from the overturned engine of the troop train. With the ashpan forced in and the fire-bars displaced, this would allow free access of the live coal to the wreckage. Coal, too, was fed into the fire from the tenders of at least three of the engines; and such coal as was left in the tenders was afterwards found consumed. Our electrical well-wishers ought after this also to protest against such a combustible as coal being carried on trains. Then the Inspector proceeds to say that the fire was afterwards intensified by the escape of gas from the cylinders as they burst. It would be exceedingly interesting if Lieut.-Col. Druitt would, in the interests of scientific knowledge and fact, inform us how the gas from cylinders charged at Larbert to the extent of five or six atmospheres—cylinders badly damaged and ruptured—would contribute to the local intensity on finding such free outlet to the atmosphere. It is really strange how high-pressure gas let loose persists in hanging about railway wreckage for the sole purpose of assisting in constructing a case for the supersession of gas by electricity. The phenomenon should be strictly investigated. However, the Inspector believes that fire would have occurred even if the vehicles had all been fitted for electric lighting, as a separate fire broke out immediately from among the waggons of the goods train, caused by the ashes from the leading engine of the express. We wonder what the Editors of the "Electrical Review" have to say to this. Fancy tough old railway waggons, without gas on them, being burned up by fire caused by live ashes from an engine! This is quite against all electrical theory governing the creation of fires on railway trains. But now we come to the recommendations. Lieut.-Col. Druitt advises that all railway coaches should be constructed of steel as far as possible, and all timber and other combustible material should be rendered non-inflammable. Then, though the evidence is so amply complete that gas was not a contributor to the fire in this awful disaster, and that fire was "inevitable" even with all the coaches electrically fitted, he proposes that gas lighting should be abolished and electric lighting be substituted as opportunity provides. We wonder why the second of the recommendations is necessary if the first one is carried out. Assuming that gas had a proved (part or whole) responsibility for these train fires, why, if the carriages are made fire-proof, deprive the railway companies of the economy of gas lighting, and the passengers of a light of low intrinsic brilliancy and of good composition? The absence of gas in this disaster, without fire-proof construction, would not have averted fire. Lieut.-Col. Druitt confesses as much. The whole report, read rightly, is a fine tribute to the safety of high-pressure gas under most terrible conditions. Gas came out of it with unblemished reputation; and yet predilection and commercial bias still ask for its conviction and eviction.

Jealousy.

Because incapable of equalling, there is great jealousy in the electricity supply industry over the work of the British Commercial Gas Association. This jealousy leads to contemptuous remarks, and those remarks—well it would not be complimentary to give them their proper description. A correspondent of "Electrical Industries," calling himself "Consumer," condemns this jealousy. He says: "The lack of enterprise of the electrical industry in regard to advertising is simply pitiful, and to sneer at gas manufacturers while they are reaping brilliant results from their methods of publicity betrays jealousy, and nothing else." He is persuaded that, by a properly organized campaign, "the public could be easily convinced of the merits of electricity, as compared with other sources of heat, light, and energy. The Editor of "Electrical Industries" hopes that "Consumer" does not suggest that "it is necessary for the electrical industry, with so much better a case to put before the public to follow the patent medicine vendor so closely as the gas industry does." Poor fellow! Jealousy must relieve itself somehow, though the choice of method is not always wise or pretty. But by the way, if the public could be so easily "convinced of the merits of electricity," and if electricity has "so much better a case to put before the public," why does it want to advertise? Surely nothing can prevent it advertising itself by proved merit, and so making express headway.

Short-Circuits on War Vessels.

Strange happenings occur to war vessels. Ships are blown up or set on fire without being torpedoed or mined. It is remembered how a French war ship some time ago was destroyed, and a great sacrifice of life resulted. The evidence went to show that, prior to the trouble, there had been difficulty with the electric lighting, and, above all places, in or contiguous to (we forget which) the powder magazine. Other singular destruction of war ships has occurred, and no reasonable explanation has been forthcoming. Now the Italian battleship *Benedetto Brin* has been blown up, and many lives have been lost. There is to be an inquiry into the cause of the explosion; but meantime it is noted that the "Messaggero" of Rome states that "the explosion would appear to be due to a short-circuit."

The "Fairy Tale" Cooker.

We should imagine the "Fairy Tale" title of this cooker a most appropriate one; though it seems to go under another name on occasion—the "Good Housekeeping" cooker. It is referred to in a letter by Mr. F. W. Fisher, of Adelaide, published in the "Electrical Review." But the cooker appears to be of American extraction. Reference was recently made to an automatic cooker, with thermostat control, introduced by the Westinghouse Company of America. Now the "Fairy Tale" cooker claims automaticity and other virtues unexcelled by any antecedent cooker. The principle is low-temperature operation; the temperature maintained being only 220° to 250° Fahr. The idea is that cooking can be carried on at about the boiling-point of water. Perhaps so; but we do not like all our food cooked as though it had been boiled. It is confessed that the system takes longer than where higher temperatures are employed. We should say much longer; and the longer the sweating process continues, the greater the exudation of the nutritive qualities of the meat. The oven is a cylindrical structure with two wings at the top serving as the hot plate. The shell of the oven is of polished steel, with cast-iron ends, &c., nickel-plated over copper. The insulating materials are mica and glass, and are tested, after completion, with 1000 volts. Mineral wool and ground cork are employed as thermal insulators. Two copper jackets form a double-walled steam chamber, and they are electrically welded together at the joints. Between the jackets is contained a small quantity of water; and the rest of the space is exhausted of air. A phosphor-bronze buckled diaphragm is attached to the bottom of the oven. The heating elements are placed directly under the outer copper jacket; and, when energized, these convert the water into steam, which distributes the heat through the space around the cooking vessels. When the temperature reaches 250° Fahr. and the steam pressure about 15 lbs. above atmospheric pressure, the diaphragm changes its shape, and presses down a loose pin, which opens the switch contacts, and turns off the current. When the temperature has fallen to 220° Fahr., the diaphragm returns to its former position, and the switch closes again. That is the electrical description. The "Review" finds the cooker would be objectionable when a meal is wanted in a hurry; and it certainly is not the best method for frying or for cooking pastry.

Costs.

We, of course, should be sorry to harshly judge anyone, or to characterize certain statements by handy expressions that readily come to mind. It is said that the cooker will work at less than half the cost of gas, owing to the diminished losses due to radiation and convection by employing low temperatures. Mr. Fisher asserts this, on prices for gas of 5s. 3d. per 1000 cubic feet and for electriciy of 2½d. per unit. The amount of gas purchasable for 2½d. at the price mentioned is about 40 cubic feet; and probably this would be gas of approximately 600 B.Th.U. gross, or 24,000 B.Th.U. for 2½d. Half a unit of electricity gives 1710 B.Th.U.; and under this is said to do an equivalent amount of work to the 24,000 B.Th.U. But there is a contradiction in an illustration given by Mr. Fisher. He says that an average meal consisting of a joint, two kinds of vegetables, and one or two varieties of sweets can be cooked with a consumption of "under one unit," whereas with gas 80 to 100 cubic feet are required. Now the 80 cubic feet of gas only costs 2d.; a unit of electricity 2½d.—under 1 unit would probably represent about 2d. There is equality. But what of the gas-cooker that takes 80 to 100 cubic feet of gas for cooking such a modest meal? Thank heavens we have had nothing of that sort in the way of gas-cookers in use in this country for the last forty years. The working man's wife with a simple construction of gas-cooker puts a good "square" meal through for the family on Sunday, by placing a penny in the slot; and, if she knows her business, there will be a surplus quantity paid for for some other purpose. The "Electrical Review" should be careful of fundamentals. There are gas-cookers in America and Australia; and there are gas-cookers such as are used in this country.

Gas from Peat.

According to the United States Consul at Amsterdam, the principal gas-works at Akkrum, in the Province of Friesland, is extracting gas from peat mixed with coal. It is stated that if peat alone were used, the retorts would become too hot, because of the steam created by the moisture always found in peat. Accordingly the retorts are filled with two parts by weight of coal to one part of peat. The gas is declared to be of excellent quality. The peat is entirely consumed in the process; and yields no bye-products. All coal, and particularly gas coal, is at present very scarce in Holland, "as it has to be imported from a great distance at heavy cost."

THE ELSWICK WORKS OF THE NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

A Partial Reconstruction.

In connection with the half-yearly meeting of the North of England Gas Managers' Association last Saturday [as reported elsewhere], the members paid a visit to the Elswick works of the Newcastle-upon-Tyne and Gateshead Gas Company, which have recently been reconstructed, under the direction of the Company's Engineer, Mr. Thomas Hardie. An interesting account of the works and alterations had been prepared for the use of the visitors, in the shape of an illustrated pamphlet, to which we are indebted for the particulars contained in this article.

The Old Carbonizing Plant.

Gas was first made at the Elswick Gas-Works in 1859; the carbonizing plant consisting of four benches of eight ovens, each containing seven retorts about 18 inches diameter in section. About the year 1870 two other benches were erected; and in 1873 and 1874 the works were practically completed by the installation of a further two benches. From that date the works consisted of 448 through retorts. The same system was followed throughout—the newer benches being duplicates of the older except as regards the section of retorts, which was changed to 20 inches by 14 inches, ◠ shaped. The general scheme was also the same. Coal was brought into the works on a high-level railway, and tipped into small waggons, from which it was deposited in front of the benches by means of an overhead railway system which ran in three parallel lengths throughout the full length of the double retort-house. The ovens were all direct-fired and hand-charged. The hot coke was removed from the retort-houses in iron barrows, and deposited in the coke-yard. This method was in operation as late as last winter, when it was necessary to work one of the last two benches of these old-style retorts which were then still in existence.

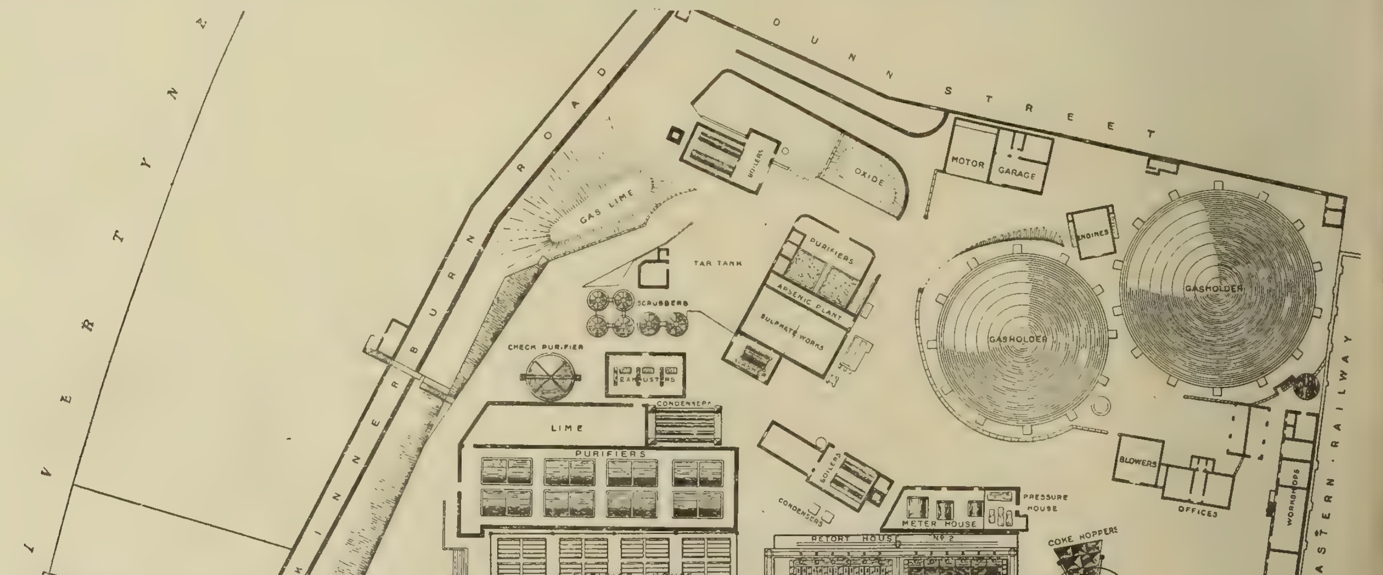
The works reached their maximum output in 1895, when nearly 5½ million cubic feet of gas was made in twenty-four hours, and the output for the year was 1140 million cubic feet. From that year onwards the developments at the Redheugh station, where the working was more efficient, caused the Elswick output to be gradually reduced, until, in the years 1909 to 1911, it was less than half what it was in 1895.

The reconstruction of the Elswick retort-houses was decided upon in the latter part of 1911; and on Dec. 29 of that year a tender was accepted for an installation of vertical retorts on the Glover-West system.

The site of the works is by the side of the river, and there is a public roadway between the riverside piece of the land and the larger part, on which the manufacturing and purifying plant is built. Further, the land is on a steep slope, and has been found to consist for several feet in depth of made-ground, with a substratum of running sand (reaching in many parts to a depth of 14 to 16 feet below ground level); while beneath the sand is a bed of good clay. Owing to the falling-away of the ground on three sides, it would have been essential, before heavy weights could be placed on the sand, to contain the ground with some form of wall. As part of the old plant was to be used while the first portions of the new plant were being built, it was not possible to proceed immediately with the demolition of the whole of the buildings covering the land to be occupied. Therefore, even if it had been preferable, the building of such a wall was impossible; and it was decided to sink all the foundations carrying considerable weights to the clay level. The cost of the foundations was consequently considerable; and the depths to which the excavations had to be sunk greatly retarded progress. The amount of material recovered from the old buildings allowed of all the concrete work being executed at a cost of 13s. 3d. per cubic yard.

No. 1 Vertical Retort-House.

The demolition of the east, or No. 1, retort-house was started on Jan. 8, 1912, and progress had been so far made by March 26 as to permit of the commencement of the brickwork of the new settings. The installation is now known as No. 1 vertical house; and the first retorts were charged on Jan. 18, 1913. No. 1 vertical house consists of ten settings, each of eight retorts. The producers are of the ordinary horizontal bar type; and the producer gas is passed into two vertical flues from which supplies are taken, mixed with heated secondary air, passed round each half of the setting, horizontally, and returned to the front, where the waste gases from all the horizontal chambers are collected in two vertical flues, which conduct them to the top chambers of the setting, whence they flow through two chambers, round the retorts,



THE ELSWICK GAS-WORKS IN 1915.

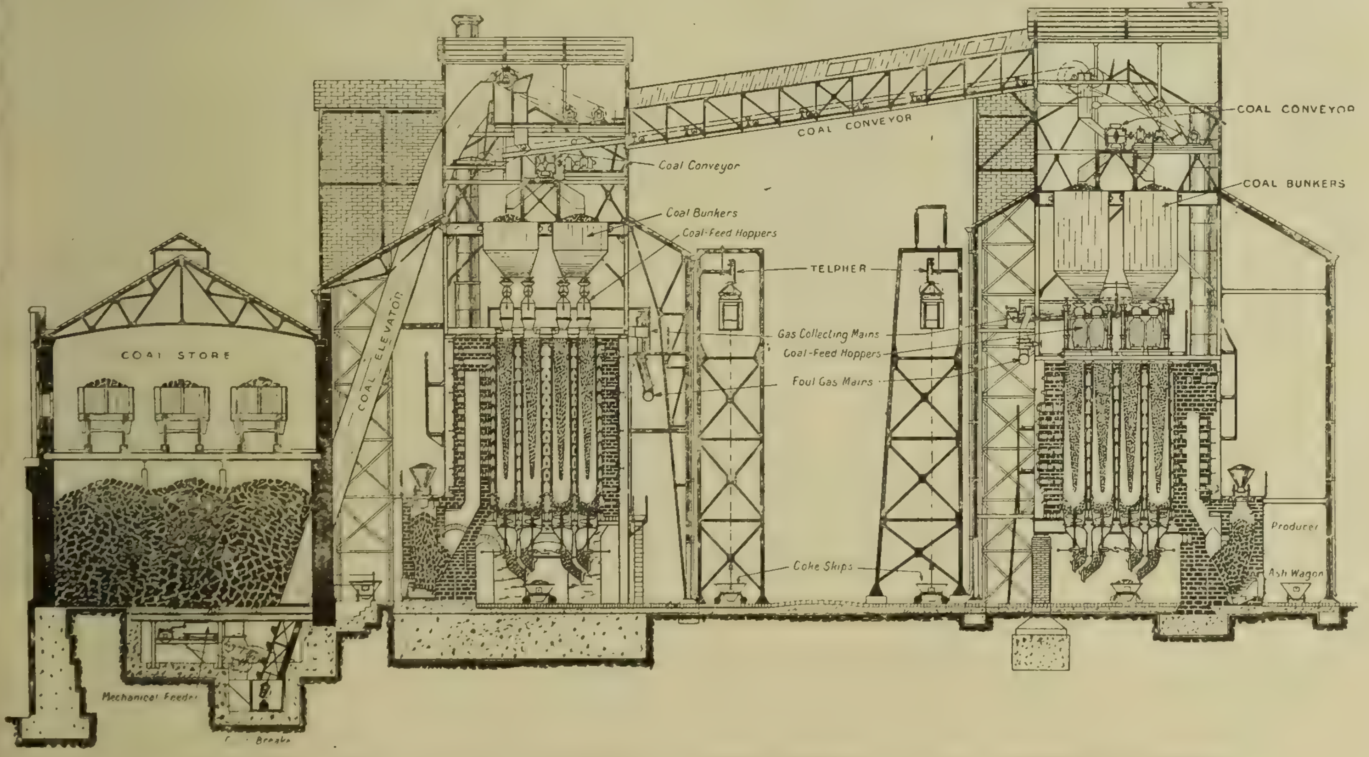
to the other side of the setting into the chimney. Each setting has its own producer and chimney.

No. 2 Vertical House.

No. 2 vertical house consists of twelve settings, each of eight retorts. The producers are of the step-grate type, and the heating is altered, inasmuch as the gases are passed straight from one side of the setting to the other, and do not return to the producer side again till the third chamber from the top is reached. This improvement has resulted in each side of the retorts being heated absolutely equally. The effect of the greater evenness of distribution of heat throughout the combustion chambers, and the greater average temperature to which the retorts are heated, is that a considerable increase in the output per retort is secured without in any way impairing the refractory materials of which the retorts and combustion chambers are constructed.

In tests made previous to the erection of the No. 1 installation, it was found that Durham coal did not pass so rapidly through the retort as Yorkshire or Lancashire coal; and it was hoped to increase the throughput by lengthening the retorts. In the first installation, however, this was found to be of no advantage. The retorts were therefore shortened in the second installation, and the section altered so as to reduce the thickness of coal in the retorts without reducing the retort capacity. Many other minor improvements are noticeable.

The benches in the first installation are carried on brick arches; but in the second they are carried on ferro-concrete piers and girders. This has resulted in making the discharging floor less enclosed, giving more freedom for working, and improving the conditions of light and ventilation. A similar improvement has been effected in the charging floor, by raising the collecting mains, resulting in the removal of any tendency to form pitch in the mains. The arrangements for the inspection and control of the heats are better in the second installation.



TRANSVERSE SECTION OF THE COAL-STORE AND RETORT-HOUSES AT THE ELSWICK GAS-WORKS.

The demolition for the No. 2 vertical house consisted of the removal of one-half of the old retort-house still standing, and was started on Nov. 17, 1913. The brickwork of the vertical benches was commenced on March 9, 1914. The six ovens of the south bench were carbonizing coal by Feb. 2, 1915; and the second bench is now practically completed.

Handling and Storage of Coal.

In No. 1 house, the overhead coal-hoppers carry a 24 hours' supply of coal; while in No. 2 house a 48 hours' supply is stored. Between the two retort-houses there is a distance of 41 ft. 2½ in., and a roadway of 16 feet between the two telpher tracks.

The overhead railway on which the railway waggons of coal were run to deliver into the smaller waggons of the Company—for use in the old horizontal houses—consisted of an embankment 23 ft. 3½ in. high by 35 ft. wide. The sides of the embankment were supported by rubble walls, which, during their long life, had become very much distorted, and had every appearance of coming to an end by a general collapse. This embankment was the property of the Railway Company, though rented by the Gas Company. It was considered essential that the embankment should be rebuilt; and to permit of this being done, the land was purchased.

It was decided that the new overhead railway should extend along the easterly wall for a distance of 535 feet, and that the portion between the new vertical house and the street should form the coal-store. Broad flange rolled steel beams were largely used in the construction of this viaduct, permitting it to be designed in an exceptionally strong and simple manner, though, owing to the contour of the site, the height of the rails above the ground level increases from 23 ft. 3½ in. at the north end to 47 ft. 6 in. at the south end. It was subsequently decided to make use of a length of 120 feet to the north of the retort-house as an extension of the coal-store, and the open side of viaduct was bricked-up to make it suitable, though no covering has yet been erected over it. The total storage capacity for coal is nearly 6500 tons.

The viaduct was designed to carry 20-ton coal waggons, which capacity is now usual upon the North-Eastern Railway. With regard to this work, which was completed towards the end of the year 1912, it is interesting to record that the whole of the railway, including timber-work, was laid down by the Company's workmen; and the large number of points and crossings were made in the Company's workshops.

While these alterations were in progress, it was necessary to deliver coals in the portion of the old retort-houses still working. For this purpose a temporary timber viaduct was erected; and a portion of this continued in use until January, 1914.

A weighbridge is placed on the viaduct near the junction with the Railway Company's sidings. The steelyard is covered by a house constructed on a cantilever extension of the cross joists; and the fact that the vibration of moving waggons does not in the least affect the weighbridge is a fairly good proof of the stability of the viaduct.

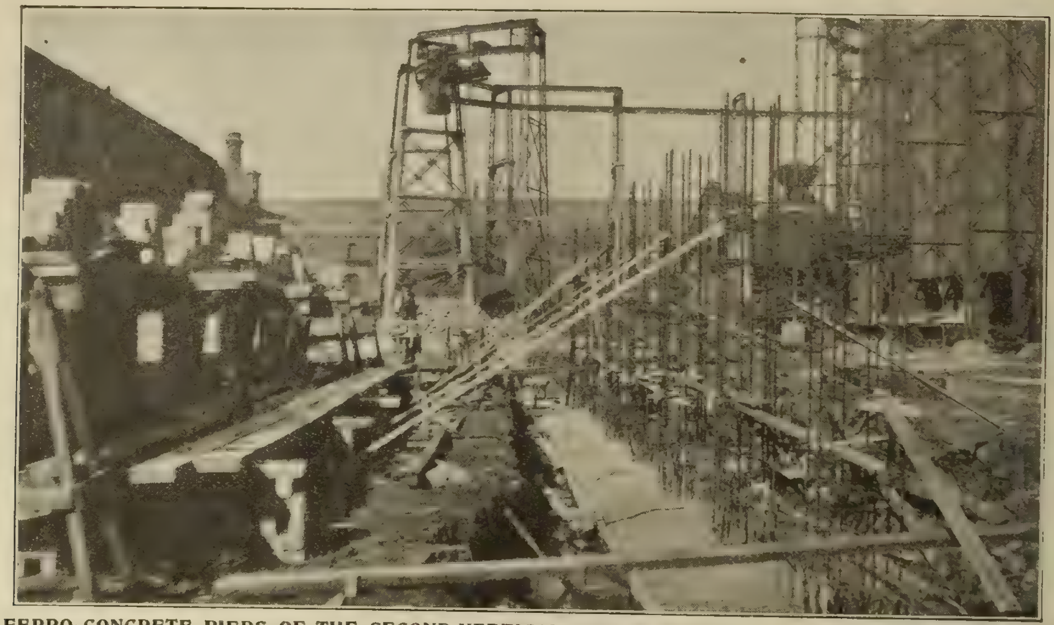
Coal Breakers and Elevators.

The coal-breakers are placed immediately under the floor of the coal-store; and, without trimming or tipping, some 575 tons of coal gravitate into them from the store. There are two coal-breakers and two elevators, each having a capacity of 30 tons per hour. The elevators can be made to deliver into one of three conveyors—into a conveyor running over the hoppers of the south bench of No. 1 house, into one running over the coal-hopper of the north bench, or into a conveyor which carries the coal across to No. 2 house. The conveyors over the coal-hoppers are of the push-plate type, and each has a capacity of 30 tons per hour. The cross conveyor to No. 2 house is a rubber belt, and has a capacity of 60 tons per hour. This conveyor delivers into two push-plate conveyors, of 30 tons capacity each, for supplying the hoppers in this house.

Coke-Handling Plant.

The coke is discharged into skips having a capacity of about 17 cwt. The skips are carried on bogies which travel along rails; and the method of working consists in discharging four retorts into one skip and running this clear of the house, where it is picked up by the telpher. The skip is returned empty to the bogie, and run back into the house ready for the next four retorts of that setting. There is in this way, therefore, one skip and one bogie for each setting. The ashes from the producers are similarly dealt with; being filled direct by the firemen into skips which are run on rails under the telpher, by means of which they are removed and emptied.

The telpher system consists of an endless track, and is 1225 feet long. There are three telphers; and they can each be used for: (1) Removing coke from the retort-houses; (2) removing ashes from the retort houses; (3) filling four supply hoppers for the



FERRO-CONCRETE PIERS OF THE SECOND VERTICAL HOUSE AND PART OF THE TELPHER TRACK.

producers; (4) loading or unloading coke or other material into the overhead railway.

The coke not required for producers is deposited by the telpher into stationary screens, where it is delivered (sized) into hoppers for despatch to the town; also into a "jigger" screen, where it is delivered into railway waggons, and the breeze and small recovered into hoppers (for town trade) or into the storage yard. In the storage yard, the telpher track standards are encased in concrete for protection.

There are three sets of overhead storage hoppers—including a ferro-concrete hopper under construction—having a capacity for 100 tons of breeze, 80 tons of broken coke, and 42 tons of unbroken coke. The "jigger" screen has a delivery capacity of 40 tons per hour.

Power Plant.

The whole of the machinery is driven by electric motors; and the electricity for these is generated by three sets of gas-engines and dynamos. The power-house is 55 feet by 24 feet by 14 feet high, and is covered with a girder and concrete roof, which carries a large water-tank and supports one pair of standards for the telpher track and a hopper for the producer coke.

There are three complete generator sets, each consisting of a 52 B.H.P. gas-engine coupled direct to a 35 K.W. compound-wound dynamo of the protected type and generating continuous current at 220 volts. Two sets are sufficient to produce the necessary current when all the plant is working as required, and one set is generally sufficient when the coal-handling plant is not in operation. The following is a list of the motors; but most of them are only in use intermittently:

Coal-breakers	2	motors	25	B.H.P. each
Coal-elevators	2	,,	13½	,, ,,
Coal-conveyors . . .	3	,,	6½	,, ,,
Do. do.	2	,,	4	,, ,,
Coke-extractors . . .	2	,,	8	,, ,,
Do. Do.	2	,,	9	,, ,,
Telphers	6	,,	10	,, ,,
Coke-lift	1	,,	9	
Do. Do.	1	,,	12	
Jigger screen	1	,,	10	

Condenser.

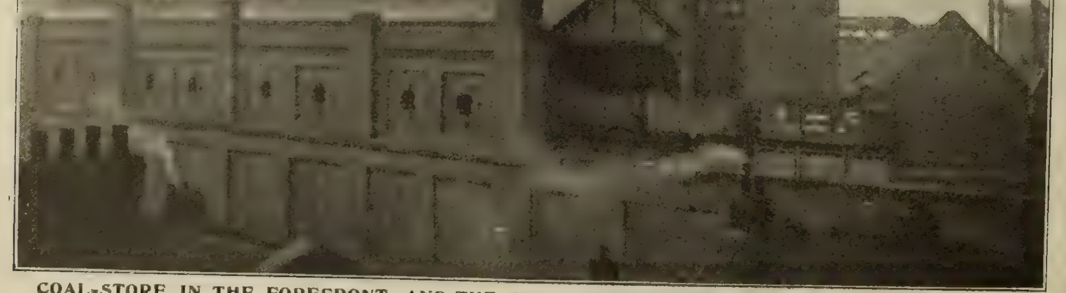
There was a very long length of 20-inch cast-iron main around the retort-houses and purifying-house, and through which the gas passed from the retort-bench to the condenser; and as the demolition threw this out of use, it was found necessary to replace it by some form of condenser. A water-tube condenser was adopted. This condenser is divided into two sections, each having a capacity of 1,500,000 cubic feet of gas—making a total capacity of 3,000,000 cubic feet per twenty-four hours. The connections are arranged so that the two sections may be used in tandem, separately, or reversed.

Purifying House.

On part of the site of the old retort-house there is now being erected a purifying-house 172 ft. by 68 ft. 9 in., which will contain eight overhead purifiers. Owing to the telpher track running through one side of the house, the construction is somewhat uncommon. The telpher will be utilized for conveying from the rail the necessary oxide, and for the purpose of despatching the spent oxide. The purifier boxes are 34 ft. by 31 ft. 6 in. by 6 ft. deep, of usual construction. They are to be worked in two sets of four each, with Weck valves. The boxes are emptied through the bottom plates. For the filling of the boxes and the lifting of the covers, there are four endless ropes running the whole length of the house, and driven from a shaft at the south end, worked by a 25 B.H.P. gas-engine. In the old purifying house are sixteen boxes, 19 ft. by 18 ft. by 5 ft. 2 in.; but they have deteriorated, and are very unsuitable for use with oxide of iron.

Water-Storage Tank.

A cast-iron tank, 42 ft. 6 in. long by 19 ft. 6 in. wide by 6 ft. deep, and having a capacity of 30,000 gallons, has been erected on the strengthened walls of an old engine-house. The water is pumped from the river, and is used for the condensers in the first instance and subsequently for the producers or for the quenching of the coke.

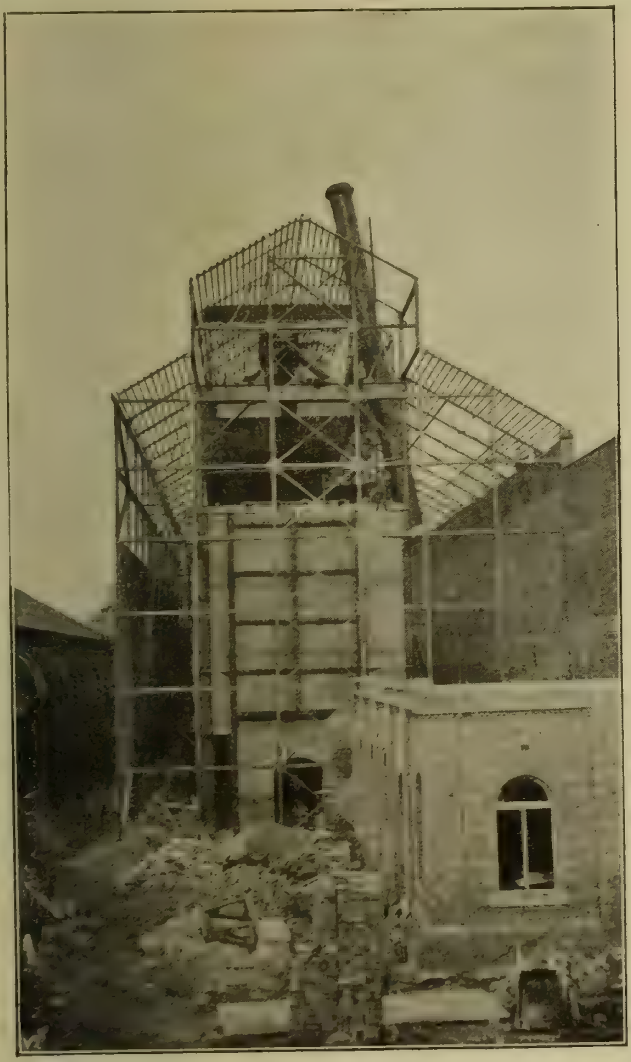


COAL-STORE IN THE FOREFRONT, AND THE FIRST VERTICAL HOUSE NEARING COMPLETION.

SHOPS, STORES, AND OFFICES.

The introduction of so much additional machinery into the works necessitated an installation of machine-tools to enable repairs to be more easily undertaken; but, owing to present difficulties, the requirements in this respect have not yet been fully met, although a rearrangement of the shops has left a certain amount of space available for the purpose.

New methods for taking out costs in greater detail and with greater accuracy required some improvement in stores, and to obtain more accommodation an upper floor was placed in the line of buildings which were then occupied as shops and stores; and the office buildings which had to be partially demolished to permit of the extension to the viaduct were rebuilt in a larger and more convenient form. The result of these alterations may be seen from the increased quantity of useful floor area obtained from the same ground space:

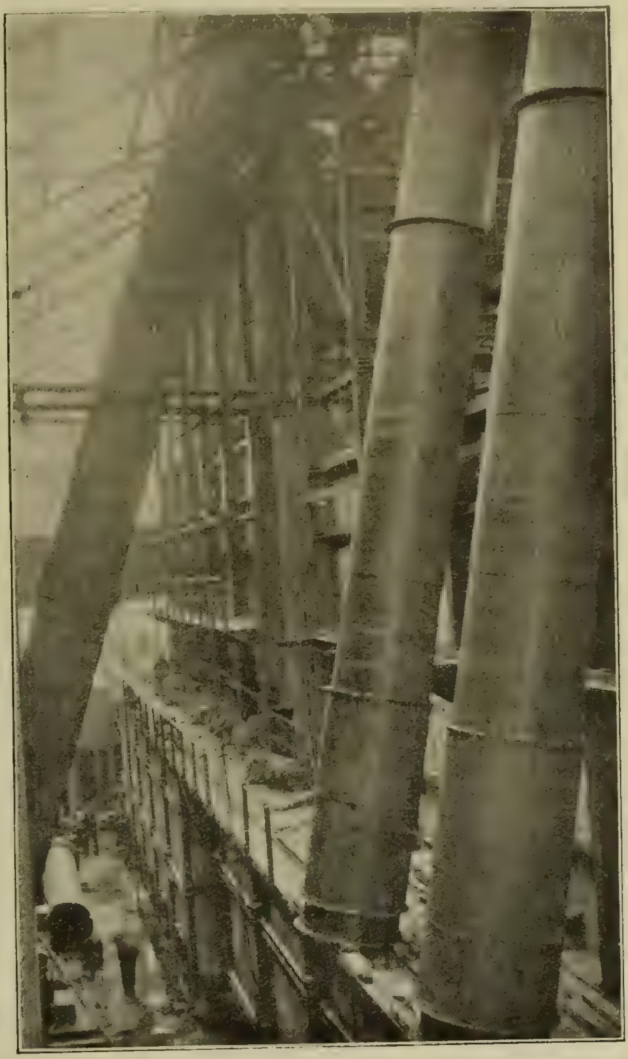


The First Vertical House in Course of Construction, with the Power House in the Foreground and the Chimney being lifted into Position.

	Before Alteration. Sq. Ft.		After Alteration. Sq. Ft.
Joiners' shop floor	624	..	946
Smiths' and fitters' shop	1333	..	1978
Stores	538	..	2308
Offices	817	..	1780
Totals	3312	..	7012

MESS-ROOMS AND LAVATORIES.

Mess-rooms and lavatories have been built over the station-meters. The roof of the meter-house had for some years been greatly in need of renewal; and in carrying out the work it was decided to put in an upper floor which would be used for mess-rooms. A floor, consisting of steel joists and concrete, was therefore laid across the whole of the house, and the walls were raised 12 feet, and a new roof constructed. Floor space was thus provided for two large mess-rooms, a latrine with accommodation for nine persons, and eight bathrooms and wash-rooms. The whole of the hot water is provided by means of a Royle's calorifier from the ordinary steam-boilers; the temperature of the water being regulated by means of a Buley blender. Each bathroom is divided by a partition, which gives every convenience for dressing and undressing. The bathrooms are heated by steam-radiators supplied from an independent, and smaller, calorifier.



The Producer Side of the Vertical Settings, with the Chimneys ready for Lifting into Position.

COKE MOTORS AND GARAGE.

The Company maintain twelve one-ton motors, which are used for delivering coke to consumers in Newcastle, Gateshead, and district. An old stable and coach-house has been extended to form a suitable garage and repair shop. The covered area of the stable was 654 square feet, and the added area 1220 square feet—giving a total of 1874 square feet.

GAS COMPRESSORS.

During the years 1912-13 four gas-compressors were installed for the purpose of supplying high-pressure gas to the town and also for supplying an outlying district about 7½ miles away. The compressors are of the following capacities: 5000, 15,000, 25,000, and 40,000 cubic feet per hour.

Figures Showing Differences between the Old and New Systems.

	Old.		New.
Area of retort-houses per ton of coal carbonized, square feet	114	..	40
Area of coal-stores do. do.		..	30
Capacity of coal-stores, tons	3,529	..	6,486
Length of double-rail sidings, feet	762	..	1,764
Gas made per ton of coal carbonized, cubic feet	11,200	..	12,764
Coke and breeze sold per ton of coal carbonized, cwt.	9·5	..	11·43
Tar made per ton of coal carbonized, gallons	9·75	..	9·31
Sulphate of ammonia made per ton of coal carbonized, lbs.	19·0	..	19·79
Carbonizing wages per 1000 cubic feet, pence	4·91	..	1·029

The figures for the new system show the actual six months' working July-December, 1913, which is the only period over which the verticals worked as a complete unit, and under normal conditions. The second installation is not yet complete; but the results have been even better since a portion of it has been put into operation.

Export of Coke.—The Coal Exports Committee wish it to be known that, though it is at present considered desirable severely to restrict the exportation of gas coke, the same necessity does not arise in the case of coke other than gas coke—such as foundry or blast-furnace coke—licences for the export of which are being freely granted.

A THERMAL STUDY OF THE CARBONIZATION PROCESS.

By Harold Hollings, B.Sc., and Professor John W. Cobb, B.Sc., F.I.C.

On May 17 last there was communicated to the Chemical Society a "Thermal Study of the Carbonization Process," by Mr. Harold Hollings and Professor Cobb, of Leeds University. In the "Journal" for Aug. 10 [p. 290] an abstract of this interesting paper appeared; but it has since been suggested that value may attach to the results set forth in the paper, not only now but in future, and that it would be useful if reference to it, in full, could be made in the pages of the "Journal." We have, therefore, secured (through Professor Cobb) the consent of the Council of the Society to reproduce the text of it from the July issue of the Society's "Transactions."

This research was commenced because of the inconclusive nature of the evidence supporting the current conception of coal distillation as an exothermic process, and because of the obvious importance of the question to the carbonizing industries.

The more technical aspect of the problem has been presented by the authors in their paper read before the Institution of Gas Engineers;* and we now collate the results for scientific purposes. Our critical study of the work already done on the thermal balance of carbonization, and our own early experiments, led us to the conclusion that both exothermic and endothermic reactions occurred; and the net quantity of heat involved was small; and that whether the net thermal result of the carbonization process at the actual reaction temperatures † was an evolution of heat or not was still an open question. When, however, the difference between the calorific values of coal and of its products of distillation ‡ was made the criterion of exothermicity in carbonization, it appeared to be proved that the distillation was exothermic—that is to say, when each reaction was taken at its value at 15° (a convention in thermochemical tables). The value of determinations of the net thermal result of carbonization is limited, in one sense, because the process cannot be represented as a single reaction. There are at different temperatures definitely exothermic and endothermic reactions which balance more or less; and, although a net result gives no evidence of the existence of such reactions, they may be of considerable importance. Modern industrial conditions are bringing into greater prominence the problems of the storage of coal; and any evolution or absorption of heat occurring in a mass of coal at a comparatively low temperature should be considered as increasing or decreasing the liability to spontaneous heating. The same consideration is of importance in determining the behaviour of masses of coal underground when raised in temperature from any cause in any atmosphere.

The experimental method we employed consisted in heating side by side, under the same conditions, a coal which underwent carbonization and a coke which could be regarded as chemically and thermally inert, and noting by means of the differential arrangement of thermocouples, devised by Roberts-Austin§ for the examination of metallic alloys, the extent to which the temperature of the coal became higher or lower than that of the coke in various stages of carbonization. Complications arising from the secondary decomposition of volatile distillation products were minimized by using a small quantity of coal, and sweeping away the products by a stream of nitrogen. Having by this means obtained "heating curves" of a bituminous coal which showed that the distillation consisted of several distinct stages, heat evolving, heat absorbing, or thermally neutral, we continued our experiments to the examination of coal extracts, to ascertain how far it was possible by this means to trace characteristics of the heating curve of coal to the influence of constituent parts of the coal itself. The heating curves of different types of coal were also constructed, and those of cellulose, dehydrated cellulose, and lignite, in order to trace, by comparison of the curves obtained, the possibly existing influence of degradation products of cellulose still present in the coals.

Experimental.

The essential parts of the apparatus used are shown in fig. 1. The coal and coke were heated in very thin fireclay boats, an enlarged view of which is given in fig. 2. A is the boat containing the coke; B that containing the coal. Fig. 3 gives the end view of the boat, and shows the three holes through which pass along thin silica tubes D, giving necessary protection to the thermocouples. C is a lid of nickel gauze to keep the coal in position during heating, after it has been packed round the silica tubes in the boat. This lid is held down by pushing it under the curved sides of the boat, as shown in fig. 3. The coke standard is previously prepared by packing the coal in A, and heating it to 1100° in an atmosphere of nitrogen.

The porcelain tube, E, in which the boats are placed, is heated by an electric furnace, F. At each end of the porcelain tube is fitted a rubber cork and a glass T-tube. The silica tubes pass through the porcelain tube, and extend beyond the T-tubes at each end. Nitrogen from a cylinder is passed through (1) a heated glass tube, G, containing copper gauze, to remove oxygen; (2) a spiral, H, containing an alkaline solution of pyrogallol, to remove the last traces of oxygen; (3) a spiral, J, containing concentrated sulphuric acid; (4) a U-tube, K, containing calcium chloride, to remove moisture. The nitrogen thus purified passes through the T-tube into the porcelain tube, E, as shown in fig. 1.

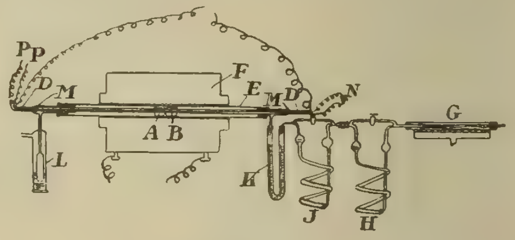


Fig. 1.

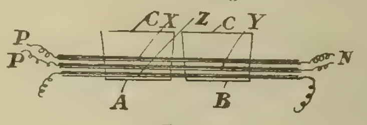


Fig. 2.

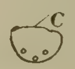


Fig. 3.

The nitrogen and volatile products of distillation leave the porcelain tube through the other T-tube, and then pass through sulphuric acid in the bottle L. The silica tubes, D, are passed through the boats A and B, being held in position relative to the boats by means of a little fireclay; and the thermocouples are threaded through the silica tubes. The two couples to be connected in opposition, so as to show the difference between the temperature of the coal and that of the coke, are arranged with their hot junctions at X and Y (fig. 2) in the centre of the coke and coal respectively. *Z* is the hot junction of the thermocouple which records the actual temperature of the coke standard. The coal is placed in the boat as described; and the boats and silica tubes are then placed inside the porcelain tube, so that the boats lie in the centre of the furnace. The corks and T-tubes are fitted to the porcelain tube, and the joints between the T-tubes and the silica tubes, D, are made gas-tight by means of wax at MM. The two platinum leads of the thermocouples, X and Y, are joined together at N, and the two platinum-rhodium leads, P, are joined by copper leads direct to the differential galvanometer. The junctions with the copper leads are made under water in a bottle well protected with cotton wool, so as to maintain both junctions at the same temperature. The two leads from the thermocouple *Z* were connected through a cold junction maintained at 16° to the Carpenter-Stansfield potentiometer, by means of which the actual temperature of the coke was measured. The most suitable rate at which to raise the temperature of the coke was found to be 7° per minute. Further experimental details, precautions, and necessary preliminaries will be found in the paper to which reference has already been made. The method of plotting the differential heating curve is the same as that often employed in metallurgical work. Deflections to the left indicate that the coal under examination is being raised in temperature more slowly than the coke standard, and *vice versâ*. It was shown that the varying heat conductivity of the coal undergoing distillation did not materially affect the curves obtained; and it seemed to us to be established satisfactorily that deflections to the left indicated a preponderance of endothermic reactions, and deflections to the right exothermic reactions. We do not attach any importance to deflections at temperatures lower than 200°.

After obtaining the heating curve of coal against a coke standard, a correction—obtained by heating the coke formed in the experiment against the same coke standard—was always applied. The validity of this correction has been repeatedly tested by reversing the position of coal and standard. The corrected curve (which alone is reproduced) represents the changes in the passage from coal to coke.

From a succession of experiments, heating curves were obtained for cellulose, dehydrated cellulose, lignite, and different types of coal. The percentage compositions of these materials are given in the following table:

	Volatile matter.*	Ash.	Ash-Free Substance. C.	H.	O.	S.	N.
Anthracite, Ystradgynlais .	5·97	2·12	89·20	4·31	3·91	1·34	1·25
Bituminous, New Hucknell	37·30	3·77	80·39	5·88	10·63	1·71	1·39
Cannel, Brodsworth. . .	45·27	4·80	80·79	5·46	10·60	1·21	1·94
Lignite, Bovey Tracey . .	65·00	5·20	63·00	6·26	28·58	1·66	0·50
Dehydrated cellulose . .	65·20	1·13	58·11	4·11	36·68	1·10	—
Cotton wool (theoretical composition)	—	—	44·4	6·2	49·4	—	—

* Determined in platinum crucible by the 1899 method of the American Chemical Society.

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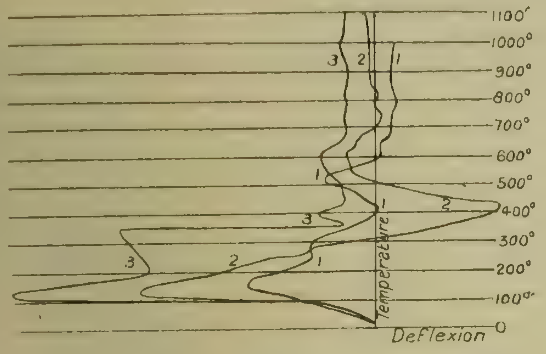
* See "Journal of Gas Lighting" (1914), Vol. CXXVI., p. 917.

† Euchène, International Gas Congress, Paris (1900), see "Journal of Gas Lighting," Vol. LXXVI., pp. 1080, 1141; and Barnum, "Proceedings of the New England Association of Gas Engineers," 1906, p. 58; also "American Gaslight Journal" (1906), Vol. LXXXIV., p. 575.

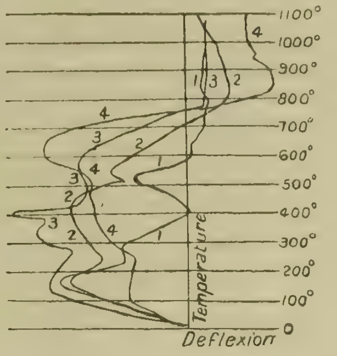
‡ Mahler, "Comptes Rendus" (1891), Vol. CXIII., p. 862; and Constam, Kolbe, and Schlapfer, "Journal of Gas Lighting," (1908), Vol. CIII., p. 382, (1909), Vol. CVII., p. 696.

§ "Proceedings of the Mechanical Engineers," 1899, p. 38.



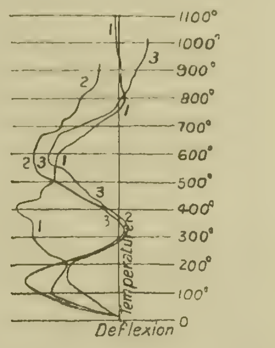
No. 1. Lignite. No. 2. Dehydrated Cellulose.
No 3. Cellulose.

Fig. 4.



No. 1. Lignite. No. 2. Cannel.
No. 3. Bituminous. No. 4. Anthracite.

Fig. 5.



No. 1. Original Coal. No. 2. Pyridine Extract. No. 3. Pyridine Residue.

Fig. 6.

The examination of cellulose was of interest in view of the origin of coal. That its distillation is exothermic has been widely noted* although Chorley and Ramsey† claimed that, with "medicated cotton wool," they obtained no evidence of exothermic change, and therefore they attributed the thermal effect to some impurity which could be removed from the wool. This we do not confirm; since the purest wool we could obtain, distilled in a similar manner to the coals, showed a very marked evolution of heat at 345°. We obtained the same result for high-grade, ashless filter paper.

The dehydrated cellulose was prepared by the action of concentrated sulphuric acid on cotton wool at 70°‡.

The black substance formed thereby was washed repeatedly, to remove excess of sulphuric acid. This very slow process was quickened in the later stages by the use of ammonium carbonate solution. It will be seen from the analysis that the amount of sulphur was thereby reduced to 1 per cent. Moisture and absorbed ammonium carbonate were removed by drying at 110°. The empirical formula of dehydrated cellulose is $C_{6\cdot00}H_{5\cdot09}O_{2\cdot84}$.

The heating curves of cellulose, dehydrated cellulose, and lignite are plotted for comparison in fig. 4. In the case of pure cellulose, the evolution of heat is very sudden, and appears to be due to chemical action at a definite temperature—namely, 345°. In the case of dehydrated cellulose and lignite, the evolution of heat is spread over a wider range of temperature (280° to 420°), and is probably due to a series of decompositions. We may point out here that in no case have we found a sudden decomposition of coal similar to the exothermic decomposition of cellulose, which is presumably connected with the expulsion of the hydroxyl groups, and consequent molecular condensation, in the residue. The commencement of the exothermic stage in the curve for dehydrated cellulose is already uncertain, although in the curve for another sample, the commencement of exothermic distillation was better defined at 280°. The exothermic decomposition ot lignite begins at the same temperature, but is very much less marked than that of cellulose. In the case of coals (fig. 5) in which, presumably, the degradation of cellulose has proceeded further still, there is practically no evidence of exothermic reactions below 400°. The comparison of curves for different types of coal—including anthracite—indicates that, in general, the thermal changes at low temperatures are characteristic of the coals in which degradation of cellulose is least complete. The most marked feature of the curves obtained for anthracite is the exothermic stage between 650° and 840°. The curves show that in the more oxygenated coals, this phase, though always very marked, falls away in relative importance, and occurs between somewhat lower limits of temperature.

One other feature in the curves which should be noted is the sharp absorption of heat in the case of the cannel coal between 510° and 550°. With the lignite this is more pronounced, and occurs between wider limits of temperature. The deflection is not so marked in the curves obtained for bituminous coal; but there is always a break in the evolution of heat in the neighbourhood of 500°. It may be connected with the distillation of oils. In the case of another bituminous coal (Monckton Main), the various stages in the curve have been examined in some detail,§ and experiments carried out to confirm the interpretations placed upon the galvanometer deflections. It will be seen from a comparison of the whole of the curves obtained that thermal phenomena in the distillation of cellulose and of coals in which the degradation of cellulose is incomplete and the oxygen content high are of most importance at low temperatures. This is consistent with the view that the thermal phenomena at low temperatures are due to the decomposition of a series of oxygenated compounds, at the beginning of which stands cellulose itself. Experiments were carried out with ceresine wax of the composition $C_{26}H_{54}$. Experimental difficulties, due to the low melting point of the substance, made the results indecisive; but, so far as they went, they showed an absence of marked thermal phenomena at low temperatures, as would be anticipated if the above hypothesis is correct. At higher temperatures, thermal phenomena are most marked with coals of low oxygen content; and presumably these phenomena are due to such decompositions of the coal substance as result in the evolution of hydrogen and the gasification of carbon in combination with hydrogen as methane. When, as in the case of highly oxygenated coals, extensive decomposition takes place at low temperatures, much carbon is given off in gaseous compounds. The residue consists largely of fixed carbon, and only to a smaller extent of coal substances decomposable at higher temperatures. On the other hand, when the degradation of the cellulose, during the formation of the coal, has been more complete, it has produced a coal substance of low oxygen content, which is more stable at the low temperatures; hence in the case of such a coal the thermal phenomena are of greater relative importance when decomposition sets in at the higher temperatures.

We are greatly indebted to Dr. R. V. Wheeler for sending for examination samples of pyridine and pyridine-chloroform extracts and residues prepared from a bituminous coal (Beeston Seam), and for supplying the following analytical data:

	C.	H.	O.	S.	N.
Original coal	83·05	5·51	8·08	2 12	1·24
Pyridine extract . . .	83·11	6·06	5·96	3·89	0·98
Pyridine residue . . .	80·80	5·69	10·17	2·43	0·91
Chloroform extract . .	75·54	7·66	14·18	1·86	0·76
Chloroform residue . .	80·25	5·28	11·45	2·09	0·93

The heating curves of the original coal, the portion soluble in pyridine, and the portion insoluble in pyridine, are plotted for comparison in fig. 6. The curve obtained for the original coal is in general agreement with those obtained for other similar coals. We had conceived it possible that the characteristics of this curve might be traced to the portions of coal separated by extraction; but this has not proved to be the case. No thermal phenomena were noticeable with the pyridine-chloroform extract; but the same difficulty was experienced as with the ceresine wax. The absence of thermal phenomena at low temperatures in the case of this product containing a high percentage of oxygen may be explained by the fact that the analyses show that there has been marked oxidation during the isolation; and this oxygen may exist in a form different from the oxygen of the degradation products of cellulose. The only point in which there is any agreement between the curves for coal and those for the portions soluble and insoluble in pyridine is in the exothermic stage about 600°; and in all respects the curves for the portions soluble and insoluble in pyridine closely resemble one another. The observations support the view that a prolonged extraction of coal by means of pyridine effects partial decomposition, not simply preferential solution.

Summary and Conclusions.

If, in these experiments, the volatile products of carbonization accompanying each endothermic or exothermic stage, as thermally indicated, had been collected and examined, a useful chemical and thermal correlation might have been effected. That we are hoping to do, at any rate, for one or two typical coals. There are some chemical data already available for the purpose. Vignon* carried out a fractional distillation of coal between certain intervals of temperature taking about the same time for a distillation as we took in our experiments. Comparison of our results with those obtained by Vignon, Wheeler, and his collaborators, and Pictet and Bouvier † would suggest the following correlation of chemical and thermal stages in carbonization.

(1) *Below* 400°.—Cellulose shows a strong exothermic reaction, commencing at 345°; but this is very much weakened in dehydrated cellulose and in lignite, and absent in the coals. It is

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* Bantlin, "Journal für Gasbeleuchtung" (1914), Vol. LVII., pp. 32, 55' Buttner and Wislicenus, "Journal prac. Chemie" (1909) Vol. LXXIX, p. 177. Klason, Heidenstam, and Norlin, "Arkiv. Kem. Min. Geol." (1908), Vol. III., No. 10.

† "Journal of the Society of Chemical Industry" (1912), Vol. XI., p. 872.

‡ Cross and Bevan, "British Association Report, 1881, p. 603. "Philosophical Magazine (1882), Vol. XIII., p. 327.

§ "Journal of Gas Lighting (1914), Vol. CXXVI., p. 922.

* "Comptes Rendus" (1912), Vol. CLV., p. 1514.

† *Ibid* (1913), Vol. CLVII., p. 779.

presumably connected with the loss of hydroxyl groups, and consequent molecular condensation, in the residue.

(2) *Between* 400° *and* 600°.—In this interval, the characteristic differences of the types of coal are manifested. Oils, unsaturated hydrocarbons, higher paraffins, and oxygenated compounds are produced in quantity and quality dependent on the nature of the coal; and the thermal phenomena are varied in a corresponding degree.

(3) *Between* 600° *and* 800°.—In this interval methane is evolved, and all the coals display marked exothermicity in passing through it. If the carbonization of coal is on the whole exothermic, as is generally supposed, it seems likely that the principal factor in determining the exothermicity is operative in this interval, and that the main reaction responsible is the exothermetic production of methane. This conclusion is supported by thermal calculation applied to hypothetical chemical equations for the carbonization of coal with and without the formation of methane.

(4) *Above* 800°.—As clearly indicated by the experiments of Burgess and Wheeler, and confirmed by Vignon, hydrogen becomes the main product of distillation above 800°. The thermal change is equally marked around the same temperature. Above 800°, the process is either thermally neutral or, more probably, slightly endothermic—presumably because the reactions producing hydrogen are themselves of that character.

(5) Thermal phenomena at low temperatures are only marked with cellulose and coals of a high oxygen content, while phenomena at high temperatures are most marked with anthracite and coals of a low oxygen content.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

A Formal Meeting in London.

When the announcement was made, it was felt that the Committee of the Association were wise, in the abnormal prevailing circumstances, in deciding to postpone until the spring of next year the general meeting usually held in the autumn, and to convene at the present juncture merely a gathering for the transaction of routine business. This took place in London last Thursday, when a fair number of members assembled to listen to some remarks by the retiring President (Mr. W. B. Farquhar, of Ilford), to welcome to the chair the new President (Mr. A. E. Broadberry, of Tottenham), and to pass several resolutions pertaining to the work of the Association.

The meeting was held in the Hertford Room, at the Liverpool Street Hotel; the chair being taken at the opening of the proceedings by Mr. W. B. **Farquhar**, of Ilford, the outgoing President.

Minutes of the Last Meeting—Apologies.

The **Hon. Secretary** (Mr. F. M. Paternoster, of Felixstowe) read the minutes of the last meeting; and they were confirmed. He then announced that a letter had been received from Mr. Thomas Goulden, the Chief Engineer of the Gas Light and Coke Company, which was in the following terms: "I very much regret that it will be quite out of the question for me to attend the meeting on Thursday afternoon, as my Directors hold their Committee meeting on that day. Will you kindly express my regret to the members present at the meeting that I am unable to be with them." Communications regretting inability to be present were also to hand from Mr. J. W. Auchterlonie, of Cambridge, and Mr. Joseph Hawksley, of Lowestoft.

New Member.

On the proposition of Mr. G. R. **Casterton** (Melton Mowbray) seconded by Mr. J. **Barton** (Peterborough), Mr. Cecil J. Robinson, the Manager of the Spalding Gas-Works, was elected as a member of the Association.

The Association and the Industry.

Mr. **Farquhar** remarked that, in calling the members together for the meeting that day, he personally regretted that the conditions prevailing at the present time had made it necessary to postpone the usual full meeting, and to hold only a meeting to conduct the ordinary routine business of the Association. It was, of course, unnecessary for him to detail the reasons for such a step, as the members were all well aware of them. The Eastern Counties Association was affected, he thought, to a greater extent than any other in the country; and the Committee considered that it would be risking the possibility of a very small attendance, and the making of the full meeting somewhat of a non-success, if it was attempted to carry out a complete programme—particularly if it meant members staying in town over-night. It was also felt that with the uncertainty of members attending, it would be difficult to arrange for a suitable luncheon at which all could sit down together. They might have got an intimation that members would be present; but there was always the possibility of raids of a certain character over the Eastern Counties, and if one of these had occurred just previous to the meeting it would have meant that many members promising to come would have had to cancel the engagement. This might have landed the Committee in the uncomfortable position of having provided for fifty or sixty when only (say) thirty might attend. There was also another point—the address of the new President would in ordinary circumstances have been given at this meeting. But he was sure they would agree with him that the address which they might expect from a gentleman of Mr. Broadberry's calibre would in that case have been entirely lost. It would not be fair to him, unless they were quite sure of having a full meeting. The news of the past few days with regard to the war had certainly been very encouraging; and they all trusted it might prove to be the beginning of the end, in which case they might well hope that by the spring—when the time for the next meeting came round—they would be able to formulate arrangements for a good gathering. He could only repeat that personally, as their President, he regretted that circumstances had not enabled him to meet with the members at full meetings. But they must take the conditions as they found them; and although only one regular meeting had been held, the members could rest assured that the Committee had carried out the various duties incidental to the Association during the past year. He might also state that the Committee had a few extra duties to perform, in connection with the conditions which all were living under at the present time. It might not be considered out of place to make a few remarks now with regard to the industry, and the effect of the war upon it. They, of course, had been hit, the same as other industrial concerns; but they were, for their part, doing their best to meet these conditions, and there appeared to be every likelihood of them weathering the storm and coming out successfully in the long run. The industry as a whole was playing a very important and prominent part at the present time in the supply of various things necessary for the country's needs. The Government fully realized the fact that the gas-works were important in this sense; but he felt the general public were not fully aware of the real importance of the position that the gas industry was in at the present time in assisting the Government. ["Hear, hear."] The public, unfortunately, resented a gas company putting up the price of their article, more than they did in the case of the general dealer. They were quite content to pay increased prices for household necessities; but when a company raised the price of gas, it was almost thought they were robbing the consumer. It was therefore a pity that the public could not be brought to realize that the gas companies and corporations were really doing extraordinary service. There were a large number of gas undertakings at the present time turning out bye-products for munition purposes. Some works, unfortunately, were not in the position to carry out the full programme of requirements just at the moment; but steps were being taken to get the necessary new plant and alterations to existing plant made, so that they could do their full share. These remarks were merely incidental to the business; and he would now proceed to the next item on the *agenda*—the introduction of the new President.

The New President.

Mr. **Farquhar** (continuing) said that, in asking Mr. Broadberry to take the presidential chair for the coming year, there was no need to introduce him to the members, as he was well known to all of them. He was the Engineer and Manager of one of the most prominent gas companies in London—a company who supplied gas at a very low price, and had works thoroughly up-to-date, which were a monument to the engineering skill and ability of the new President. ["Hear, hear."] He was sure Mr. Broadberry would be of great assistance to the Association; and the information he could impart to them would be listened to with the greatest respect, as coming from a gentleman well versed in everything pertaining to gas-works and gas management.

Mr. A. E. **Broadberry** (Tottenham), who was greeted with hearty applause, then took the chair, and said that, in the first place, he wanted to thank Mr. Farquhar for the very kind words he had spoken in introducing him to the members as their new President. He only hoped that he might deserve all the complimentary things that had been said. At any rate, he would do his best to deserve them. He also wished to thank the members for the hearty reception they had given him. It was a great compliment to him that so many should be present on this occasion, as the business was entirely formal. The attendance was also a compliment to the late President, Mr. Farquhar. Having welcomed him into office, the members gave him their support on his leaving the chair.

The Past-President's Medal.

The **President** said his first duty was to present to Mr. Farquhar, on behalf of the members, the Past-President's Medal.

This had become quite a custom in the Eastern Counties Association; but it must not be considered that it was a mere formality—for it was not. It was an expression of appreciation on the part of the members of the good work that the President had done for the Association during the year; and in the case of Mr. Farquhar, he thought they would all agree that the duties had been carried out in an excellent manner, and under difficulties such as no previous President had had to face. [Applause.] The trying times through which they had been living during more than twelve months past must have created many difficulties for the President; and yet he had managed to carry on the affairs of the Association to the satisfaction of every member. He found time to prepare and read to them what was described correctly in the minutes as a most instructive and interesting address; and he had also prepared some remarks for this meeting, to take the place of the address which he (the speaker) would have delivered if times had been normal. On their behalf, therefore, he had very much pleasure in presenting the medal to Mr. Farquhar. He trusted he would live long to wear it, and that it would always remind him of the very great esteem in which the members of the Association had held him as their President.

Mr. Farquhar, in acknowledgment, assured the members that the medal would be one of his treasured possessions, and that it would always serve to keep in mind the year in which he occupied the chair. In a sense, there was really no need for such a token, because he should always look with pleasure on the time he had spent on the Committee, and also as President. He could only hope that he had really earned all the kind things Mr. Broadberry had said, and the good opinions of the members generally.

Representative on the Institution Council.

The President said they had now to elect a district representative on the Council of the Institution of Gas Engineers. It had been the custom, he believed, in the Association to elect as their representative the President for the year; but it so happened on this occasion that their President was already on the Council of the Institution, and therefore they would not be taking advantage of the opportunity of securing further representation if they were to elect him. In the circumstances, he thought the best thing would be to re-elect Mr. Farquhar as the Association's representative; and he proposed this.

Mr. J. H. Troughton (Newmarket) seconded the resolution, and it was unanimously passed.

Place of Next Meeting.

The President said the next matter they had to consider was the place of the spring meeting. It was rather difficult at present to lay down anything very definite for this. His Directors hoped they would be given the opportunity of offering the Association hospitality in some form; and therefore it looked as though it would be desirable to hold the meeting in London. The Committee could, however, hardly decide now whether it should be a one or a two day meeting. A great deal must depend upon how matters progressed abroad. He sincerely hoped—though there did not seem to be much probability of it—that by the time of the meeting peace would have been reached, which would justify them in having a two-day meeting. But, whichever way it was, he was asked by his Directors to extend to the members of the Association an invitation to be their guests, either at luncheon or dinner, as might seem most suitable. In any case, if it was the wish of the members that the spring meeting should be held in London, he offered them a hearty welcome on behalf of his Directors.

Mr. J. Davis (Gravesend) said that, after the remaks made by the President, they could not do better than accept his suggestion, and leave the matter to the Committee to arrange.

This was agreed to.

Votes of Thanks.

Mr. Barton, in proposing a vote of thanks to the President, Officers, and Committee of the Association for their services during the past year, said they had carried out their duties uncommonly well, under very trying conditions. He thought they had done the right thing that day in calling the members together to carry on the formal business of the Association.

Mr. Casterton having cordially seconded the proposition,

The President said that, in putting it to the meeting, he would like to add his word of praise of the way in which the Committee had done their share in carrying on the work of the Association; and he would particularly like to include the name of Mr. Davis, for his services as Hon. Secretary. Mr. Davis, as they all knew, always put his heart and soul into the work that he had to do; and much of the success of the Association had been due to the careful way he had arranged every part of the business.

The resolution was carried with applause.

Mr. Davis, in responding, remarked that if he had done anything to deserve what had been said, it was because he had received the hearty assistance of every member. He only hoped his successor would do a great deal better than he himself had even attempted to do. He relinquished the secretaryship with a good deal of regret in one way; but he felt sure the gentleman who was succeeding him would do all he possibly could to enhance the fortunes of the Association. He thanked them all heartily for the assistance he had always received, and for the good fellowship and good feeling he had met with ever since he had had the honour of being Secretary of the Association.

The proceedings then ended.

MEASUREMENT OF ILLUMINATION.

The last part it is intended to reproduce *verbatim* of the report issued during last month of the Departmental Committee on the Lighting of Factories and Workshops, is Appendix XVII., which is, to an extent, a supplement to the section of the report that appeared in the "Journal" last week, pp. 706-7. It is as follows.

Explanations of the terms "illumination" and "surface brightness" have been given in the report; but it may be useful to consider briefly the methods by which they are measured.

The brightness of a surface, as has been shown, depends not only on the amount of its illumination, but also on the fraction of the incident light which it returns to the observer. This fraction is known as the "coefficient of reflection of the surface," and is often conveniently expressed as a percentage. It varies from about 90 per cent. in the case of very white materials to 2 or 3 per cent. for black velvet. A perfectly white surface would return 100 per cent. of the light that is incident on it; but no such ideal surface is known.

If the illumination at a certain surface is 10 foot-candles, and the surface has a coefficient of reflection of 50 per cent. (thus returning only half the light it receives), it will only appear as bright as a perfectly white surface illuminated to half the extent—viz., to 5 foot-candles. It is often useful in this way to express the surface brightness of an object in terms of the illumination required at a perfectly white surface to make the brightness of the latter equal to that of the object in question.

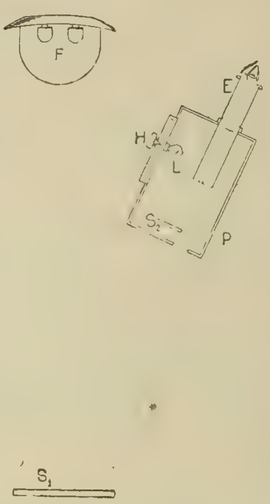
> Example: A piece of grey cloth has a coefficient of reflection of 20 per cent., and is illuminated to 5 foot-candles. Its surface brightness would be matched by a perfectly white surface illuminated to $5 \times \frac{20 \text{ per cent.}}{100 \text{ per cent.}} = 1$ foot-candle.
>
> The equivalent surface brightness of grey cloth under these conditions is thus said to be 1 foot-candle.

It is here assumed, for the sake of simplicity, that at a given illumination a surface has the same brightness whatever be the direction from which it is viewed, or whatever be the direction of the incident light. It is obvious that in the case (for instance) of a mirror, this will not be true. If a beam of light coming from a definite direction (*e.g.*, that given by a hole in a card placed in direct sunlight) falls upon a mirror surface, there is one particular direction along which the greater part of the light composing the beam is reflected; and so regular is the reflection that an observer sees an image of the hole as he looks towards the mirror from that direction. From any other direction, however, the mirror reflects practically no light whatever towards the observer—all the light having been sent off in the one direction. Such reflection, concentrated almost entirely in one direction, is called "regular" reflection. Supposing, now, a very "matt" (*i.e.*, unglazed) surface, such as a sheet of white blotting-paper, is put in the place of the mirror, and illuminated in the same way, no direction can be found in which the reflected light is much stronger than it is in any other direction. The blotting-paper looks equally bright from all positions, because its surface has the property of scattering the incident light and reflecting it in all directions. In this case the reflection is said to be "diffuse." Both the mirror and the blotting-paper reflect approximately the same amount of the total incident light (between 80 and 90 per cent.). That is to say, their coefficients of reflection are the same. But in the case of the mirror, the reflection is regular, while in that of the blotting-paper it is diffuse. The two cases considered are extreme; and most surfaces fall between the two—that is, a certain and usually the larger proportion of the light incident on them is diffusely reflected, the remainder being more or less concentrated in one direction. For very many of the substances dealt with, the proportion of regularly reflected light is small enough to introduce no serious practical error in ordinary measurements of surface brightness, although in such measurements the surface is always assumed to be completely diffusing. This assumption has been made with regard to the surfaces treated in this appendix.

Apparatus for Measuring Illumination—See p. 28.

Apparatus for measuring illumination consists, in its simplest form, of two identical white surfaces so arranged that they can be compared together. The first, S_1, is placed at the point where the illumination is to be measured, and receives on it all the light incident at that point; the second, S_2, is illuminated to any desired and known amount by some source of light under control. When the brightness of this second surface matches the first one, its illumination (being known) is a measure of the unknown illumination at surface 1. The various instruments used in practice merely differ in the methods adopted for adjusting the illumination at surface 2, and also in the devices employed for conveniently comparing the two surfaces together.

Arrangements are made within the instrument so that when looking through an eye-piece one portion of the field of view is occupied by a portion of surface S_2 of variable brightness, while the other portion is unobstructed. Then, by suitably directing the instrument, the surface S_1 may be seen filling the unoccupied portion of the field of view. The brightness of the variable surface S_2 is then adjusted, in this case by moving the lamp L towards or away from S_2, until the whole field of view appears equally bright. The illumination can then be at once read off on the scale.



P is the photometer case containing L the electric lamp, S_2 the surface whose brightness is varied by moving L, and E an eye-piece. S_1 is the other surface, placed at the point at which it is desired to measure the illumination produced by the lamp F. The surfaces S_1 and S_2 are observed simultaneously through E; and the handle H is moved until S_1 and S_2 appear equally bright. As the movement of the handle regulates the illumination at S_2, each position taken up by it corresponds with some definite illumination. These illuminations are marked on a scale over which moves a pointer attached to the handle; so that, when there is equality of brightness, the scale reading indicated by the pointer gives at once the desired value of the illumination at S_1.

If an operator wishes to know the illumination at the needle of a sewing machine, he has only to lay his white surface S_1 on the table of the machine against the needle, and direct his portable photometer towards it—adjusting his instrument until, as described above, equality of brightness exists over the field of view. The reading of the instrument then gives the illumination at the point on the sewing machine covered by the white card. Usually it is the illumination at a horizontal plane which is required to be known, because, as a rule, the object worked upon is approximately horizontal, or has to be viewed by the work-person from a point immediately above it. Cases, however, may arise—such as on a compositor's frame—in which the important plane is not horizontal but is appreciably inclined; and in this case the card may have to be placed at an angle. The illumination at a vertical plane is seldom required; but if, for instance, the illumination of picture galleries were under consideration, it is obvious the vertical plane would be more important than the horizontal one.

It will be seen from the foregoing description of a photometer that, although it is the brightnesses of the two surfaces S_1 and S_2 which are to be compared, yet, since they both have the same coefficient of reflection, the instrument can be and is scaled to measure illumination. It would be equally easy to scale the instrument to indicate equivalent surface brightness; but measurements of illumination are more often required than those of surface brightness. If an ideally white surface could be obtained for the surface S_1, the scales of illumination and equivalent surface brightness would be identical. A measurement of illumination at the white card, therefore. can be converted into a measurement of its equivalent surface brightness by multiplying the reading of the instrument by the coefficient of reflection of the white card.

> Example: If the illumination at the white card is measured as 1 foot-candle, and the coefficient of reflection of the white card is 0·85 (85 per cent.), the equivalent surface brightness of the white card at this illumination will be 1 × 0·85 = 0·85 foot-candle. Similarly, if the standard surface in the instrument be matched against the surface of any other material (such as a piece of cloth or wood), the equivalent surface brightness of such cloth or wood can be determined by multiplying the instrument reading by 0·85.

The coefficient of reflection of any surface is, of course, readily obtainable by measuring: (1) The illumination at such surface, and (2) its equivalent surface brightness under that illumination. The surface brightness divided by the illumination gives, at once, the coefficient of reflection.

The principle of the illumination photometer has been explained above in its simplest form. By adopting a suitable method of calibration, it is not necessary for the internal and external white surfaces to be identical, nor for the external surface to be detached from the instrument. These, however, are details of construction, and do not affect the main principle.

The variable brightness of the surface S_2 within the instrument is obtained in many ways in illumination photometers now in common use. Among these methods are the following:

(1) Changing the distance of the internal surface from the lamp illuminating it.

(2) Varying the intensity of the light from an electric lamp shining directly on the surface and contained within the instrument. This is effected by introducing into the lamp-circuit a resistance operated by a slider with a pointer attached.

(3) Changing the inclination of the surface to the rays from a lamp. The change in inclination is produced by turning a knob to which the pointer is attached.

(4) Using as the light source to illuminate the surface a greater or less area of another constantly illuminated surface. The area is changed by the movement of a shutter controlled by a handle with a pointer attached.

The material used for the white surfaces must be carefully chosen. No surface is obtainable which will return all the incident light; but in practice a material is chosen whose surface reflects as much of the light as possible. This surface must, as far as may be, fulfil the following conditions:

(1) It must be readily reproducible, in order to facilitate replacement without any necessity for readjustment of the instrument which has been calibrated by means of it. It will be observed that any change in the coefficient of reflection of the standard surfaces used with any given instrument would invalidate the readings of the instrument to the extent of the change.

(2) The surface must be as "matt" as possible, in order that it will appear equally bright whatever be the direction from which it is viewed.

(3) It must be white—that is to say, it must reflect in equal proportions all the light rays incident on it, whatever may be their colour.

A material often used for the purpose is opaque white celluloid prepared with a specially matt-surface. It is, as far as can be judged, quite white; and the surface can be made so matt that, over a considerable range of direction, the brightness remains sensibly the same. If it becomes soiled, the surface can, with a little care, be restored to its original condition.

COMPLAINTS AGAINST THE GOVERNMENT MINES IN GERMANY.

The following is a translation of an article in the "Vossische Zeitung" of the 27th ult.

We learn from the Town Hall that, while the Berlin Gas-Works have, for the last year, been doing their utmost to obtain the coal required to ensure an adequate supply of gas for Berlin, and a sufficient quantity of coke for the inhabitants, the Government mines have cancelled 30 per cent. of the quantity of coal sold to the gas-works, and have agreed to supply only half the quantity of coal they require. The result of this has been to compel the gas-works to buy in Moravia, Bohemia, and Poland coal which does not yield a suitable coke. Now there is a shortage of coke; and the inhabitants of Berlin are clamouring for this fuel. One would think the parties concerned would decide to supply sufficient coal to the Berlin Gas-Works; but far from it—the gas-works are bye-passed. The Prussian Government mines have recently issued an official notification that care will be taken to supply sufficient coke to the wholesale dealers in Berlin. It is quite untrue to say that only the Berlin Municipal gas-works are in such an awkward position as regards the supply of coke. A large number of German towns are in the same position. It would almost appear as if the situation resulting from the war were being taken advantage of to make the Municipal gas-works pay for having carbonized English as well as German coal for many years. It is quite wrong to assume that English coal alone was used on the Berlin works. This only took place in so far as it was necessary, in view of recognized commercial principles, and to safeguard the interests of the ratepayers in times of peace.

The Municipal gas-works have always readily acknowledged that German coal yields good coke. Westphalian and Lower Silesian coals, indeed, yield very hard coke. It is only when Upper Silesian coal is mixed with Austrian and Polish coal—which has lately had to be used owing to dire need, and which yields soft coke—that this Silesian coal does not yield good coke. Anyone acquainted with the present circumstances would conclude that it would be very greatly to the interests of the Prussian mines to assist gas-works in carrying on their business.

This is as far as the *communiqué* from the town hall goes. The attitude taken up by the Prussian mines is the more remarkable because, about nine months ago, at the instigation of the Government, the inhabitants of the city were earnestly requested to use coke for fuel. This well-considered appeal was made in the interests of the Fatherland. The bye-products from the gas-works play no unimportant part in the production of modern explosives. Large factories have, in consequence of this appeal, arranged their furnaces exclusively for coke; and in many private households this example has been followed as far as possible. Surely the Prussian mines will not, as a reward for meeting the Government's wishes in this respect, place all sorts of difficulties in the way of the Municipal gas-works.

It is not to be wondered at that, in circles which are hit most severely by the want of coke, extraordinary ideas are arising as to the reasons which led to the appeal to burn coke being made. In many communications addressed to us, correspondents openly express the opinion that the sole object of the appeal was to cause an artificial shortage of coke at the commencement of the autumn.

Rome and its Water Supply Fifty Years Ago.—In last Friday's "Builder" there was reproduced the following paragraph from their issue of Sept. 30, 1865: We mentioned some short time since the probability of the Aqua Marcia, celebrated in ancient times, being brought to Rome. We can now state that the concession was granted by the Roman Government on the 30th of August last, to Mr. Shepherd, the *gérent* of the Roman Gas Company, in conjunction with Mr. Henry Fawcett, of the Temple, London. We understand the enthusiasm in Rome on the subject will leave little to be done in London in establishing a Company.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Newcastle-on-Tyne.

The Half-Yearly Meeting of the North of England Gas Managers' Association was held last Saturday afternoon in the lecture theatre of the Institute of Mining and Mechanical Engineers, Neville Hall, Neville Street, Newcastle-on-Tyne. Mr. Thomas Waddom, the Secretary of the Newcastle and Gateshead Gas Company, the President of the Association, was in the chair; and there was a large attendance of members. Previous to the meeting, the members visited the Elswick Gas-Works of the Newcastle and Gateshead Gas Company, and inspected the new plant, including the installation of vertical retorts—described on p. 20. The Engineer of the Company, Mr. Thomas Hardie, and other of the officials showed the visitors over the whole of the works. At the close of the tour of inspection, light refreshments were served. The meeting at Neville Hall commenced at two o'clock.

Letters of Regret.

The Hon. Secretary (Mr. Herbert Lees, of Hexham) read letters of apology for absence from Mr. John Young, the President of the Institution of Gas Engineers, Mr. Drury, and other members of the Association.

An Acknowledgment from Mr. Doig Gibb.

A letter was received from Mr. W. Doig Gibb, in acknowledgment of a resolution passed at a meeting of the Association in May last, expressing thanks for the kind message of the Association, and stating that it was pleasing to him to think that his old friends of the Association did not forget him.

Losses by Death.

The President then referred to the loss which the Association had sustained within the last three weeks by the death of two of their oldest members—Mr. Thomas Bower, of West Hartlepool, and Mr. Joseph Hepworth, of Edinburgh. Mr. Bower became a member on April 26, 1884, and occupied the presidential chair in 1888-9. He had served on the Committee on several occasions, and during the 31 years of his membership was one of the most regular and valued contributors to the proceedings of the Association, either by paper or discussion. They mourned his calm presence, sound judgment, and quiet humour. Mr. Hepworth became a member on April 10, 1877, and was elected the Association's first Vice-President, and occupied the position of President in the succeeding year. In the early days of the Association he rendered very valuable service; and during his 38 years' membership his broad experience was always available for the welfare of the Association. The President said it was fitting the meeting should pass resolutions of sympathy with the families who were now in mourning. These resolutions would, he thought, be of some consolation to the families of the deceased gentlemen, and would convey to them the great respect in which the deceased members were held by those who had been closely associated with them in their professional capacity. He moved the following resolution:

> That this meeting records with deep regret the death of Mr. Thomas Bower, who for the past 31 years was a member of the Association, during the whole of which time he took keen interest in the work of the Association, filled the office of President in the year 1888-9, was a member of the Committee for several periods, and frequently contributed to its proceedings, and thereby rendered most valuable service to the Association; that this resolution be communicated to Mrs. Bower with an expression of sincere sympathy.

Mr. W. Hardie (Tynemouth), in seconding, said Mr. Bower was a personal friend of a great many of them, and they all realized the loss they had sustained. It was a great sorrow to him, on returning from a holiday, to learn that Mr. Bower had passed to the majority.

The resolution was carried in silence.

The President then moved:

> That this meeting records with deep regret the death of Mr. Joseph Hepworth, who was one of the founders of the Association and its second President, filling that office in the year 1878-9. During the earlier years of the Association's history he was one of its most active members. He served on the Committee for several periods, and was a frequent contributor to its proceedings, and thereby rendered most valuable service to the Association; that this resolution be communicated to Mrs. Hepworth with an expression of sincere sympathy.

Mr. William Ford (Stockton) seconded the resolution of condolence, and said he did so with great regret, as Mr. Hepworth was a personal friend of his. He was in Edinburgh a few days before Mr. Hepworth's death, and he was deeply sorry to be told that there was no hope for his recovery. When he returned to Stockton the next day, he found in the newspapers the record of Mr. Hepworth's death.

The motion was agreed to.

Congratulations to Mr. J. H. Penney.

The President went on to say that he felt sure the Association would offer its very hearty congratulations to Mr. J. H. Penney, who had recently celebrated his jubilee with the South Shields Gas Company. He also was one of the founders of the Association. Mr. Penney became a member of their body in 1877, and was their first Auditor—a position which he held until 1895, when he was elected a Vice-President, becoming President in 1896-7. At the end of his presidential year, Mr. Penney succeeded the late Mr. William Hardie in the office of Hon. Secretary and Treasurer; and he discharged the duties of that office for five years. Mr. Penney did much useful work in connection with employers' liability insurance. The President said he felt sure it would be the wish of the members that the Secretary send to Mr. Penney a letter conveying their appreciation and congratulation. [Applause.] The President said there were only four of the early Presidents still with them—Mr. Penney, Mr. William Ford, of Stockton (who they were glad to see with them that afternoon, hale and hearty), Mr. Charles Potter (Chairman of the Walker and Wallsend Union Gas Company), and Mr. J. T. Jolliffe, then of Sunderland, now of Ipswich. Mr. Waddom mentioned that there were also among the original members Mr. James Whyte, of Seaham Harbour, Mr. Tobey, of Malton, and Mr. Richley, of Shotley Bridge.

New Members and Associates.

The following new members and associates were elected:

Members.—Mr. Frank Herbert Robinson, Harrogate Gas Company. Mr. Ernest Mills Archbold, Alnmouth Gas-Works. Mr. A. Phillip Allan, Scarborough. Mr. Harold Parks Allison, Yarm-on-Tees Gas Company.

Associates.—Mr. Stanley Sadler, Middlesbrough. Mr. Hubert Dunbarand, Hartlepool Gas and Water Company.

The President then delivered the following

PRESIDENTIAL ADDRESS.

Gentlemen,—I thank you most sincerely for the honour you conferred upon me eighteen months ago in electing me to the presidency of this Association, and, again, last May, re-electing me, in consequence of the exceptional circumstances preventing the usual meeting being held last October, when, in the ordinary course of events, the Presidential Address would have been delivered. It was hoped, when the decision to abandon the October meeting was made, we might be in a position to meet this year under happier conditions; but, alas, the hope has not been realized. I assure you that I appreciate the honour of being your President, and only regret we meet to-day under the shadow of a cloud which darkens the whole of Europe—I may almost say the whole world.

THE WAR.

Our nation is at war, and such a war as has no parallel in the history of the world. Practically the whole of Europe is under arms if not in actual conflict. We have drawn the sword to vindicate the right of nations to exist peaceably, free from the thraldom of another nation which has, unprovokedly and after deliberate preparation extending over many years, plunged Europe into a war with the avowed object of establishing for itself an absolute world-power—such war to be prosecuted by means of a system of militarism, barbarism, and terror in which the principle of might and not right is the basis. Could it, in these circumstances, be doubted that the nations sought to be conquered would take up the sword in the cause of all they hold most dear—their hearths and homes and the ideals of justice and equity as between nations great or small? No! there was no hesitation. The challenge was accepted, nation joined nation, and our dependencies rushed to the support of the Mother Country. Our Prime Minister declared that the sword would not be sheathed till the aggressions against Belgium and France were redressed and the rights of the smaller nationalities of Europe were placed on an unassailable foundation, and until the military domination of Prussia was wholly and finally destroyed. So also declared our Allies. Such is the unanimous resolve of the peoples of this nation and the allies with whom we are associated, however long it may take to end the titanic struggle; and may God in His mercy give us the victory soon.

EFFECT OF THE WAR ON THE GAS INDUSTRY.

The gas industry has necessarily, in common with other industries, been subject to much disturbance in consequence of the war—some gas undertakings more than others; but to all the work of fulfilling duties to consumers, shareholders, committees, and directors has been rendered exceedingly difficult. With crippled resources in labour and material, the gas-works are being efficiently carried on, even where the requirements of the consumers have been very largely increased. With coal and other material very dear, and difficult in some instances to obtain at any price; with the price of gas to consumers raised; and dividends and aids to rates reduced—all have been loyally and patriotically borne for the good of the cause whatever sacrifice was involved.

As an instance of how an undertaking has been affected by the enlistment of a number of its employees, and others leaving for munition work, while at the same time called upon to supply a large increase of gas, the following statement of the Newcastle Company's experience may be interesting:—

Number of Employees.

	Elswick.	Red-heugh.	Distri-bution.	Offices.		Total.
				Male.	Female.	
Maximum (Winter)—						
1913-14	189	765	800	158	4	1916
1914-15	219	769	735	142	17	1882
1915-16 (estimated) .	250	769	450	129	25	1623
Employed in September—						
1913	163	570	758	158	4	1653
1914	147	604	704	142	17	1614
1915	211	571	433	129	25	1369
Short of maximum .	39	198	367	29	21 (plus)	612
Left during war (Males only) for:						
Enlistment—						
Regular employees	32	187	131	43	..	393
Temporary ,, .	5	30	1	..	..	36
	37	217	132	43	..	429
Munition work . .	..	8	182	..	..	190
Other reasons . .	29	5	16	5	..	55
	66	230	330	48	..	674
Taken on during war .	26	190	49	24*	..	289
Net depletion . . .	40	40	281	24	..	385

* Practically all youths.

Make of Gas and Men Employed at the Gas-Works.

(Two first weeks in September.)

		Thousands. Cubic Feet.	Men Employed.
1913 ..	First week ..	57,525	733
	Second week ..	62,768	
1914 ..	First week ..	61,439	751
	Second week ..	62,222	
1915 ..	First week ..	64,812	782
	Second week ..	66,421	

(Winter make—October to March.)

	Thousands. Cubic Feet.	Men Employed.
1913-14.	2,313,232 ..	954
1914-15.	2,573,055 ..	988
1915-16 estimated 5 per cent. above 1914-15	2,701,705 ..	1019 (estimated requirements)

The difference between men now employed (782) and the maximum requirements for the coming winter (1019) is thus 237.

It will be observed that, so far as the gas-works are concerned, the difficulty will increase as the winter reaches the maximum requirements. I therefore trust that the Government will, in whatever measures they may take to obtain men for the vigorous prosecution of the war, recognize the essential character of the work that is being done by gas undertakings.

Of the decrease in the number of men in the Distribution Department, 98 is due to the non-lighting of the public lamps since April last, and the remainder to the very proper decision of the Directors to comply with the strong appeals of the Government not to hinder men as far as practicable from enlisting or working on munitions.

The only department in which material reductions in labour could be carried out without jeopardizing the supply of gas was the distribution—by curtailing the supply of new appliances other than those necessary for the requirements of the war. This decision took effect from the beginning of July last—notices being posted in the offices and show-rooms; and I am pleased to say the public have most patriotically co-operated with the Company in postponing the fixing of appliances.

We are all proud of the patriotism of the employees of our respective undertakings who have volunteered to join the Colours, and, if need be, to lay down their lives for the sake of our country. And we are glad that employers have seen fit to show their gratitude and appreciation by making generous provision for the dependants of our brave fellows and guaranteeing work for them when they return. I am sure that I express your feelings in this respect, and also in wishing them God-speed and a safe return to their homes and work.

EXPORT RESTRICTION AND BYE-PRODUCTS.

Exports of residuals have been much interrupted by the war and the necessary regulations of the Government as to licences, which fall more heavily upon statutory gas manufacturers than others with greater freedom as to production. Gas must be made to meet the requirements of those who consume it, including those to whom it is essential for the manufacture of munitions of war; and the bye-products must be disposed of by exportation where the quantity made exceeds the requirements of the district. The question of export applies more particularly to coke and sulphate of ammonia; and it is to be hoped that the difficult conditions to which I refer will be fairly recognized by the Exports Committee in granting or refusing licences. It was for some considerable time from the commencement of the war practically impossible to dispose of pitch, owing to the effect of the war in France and Belgium, to which countries it has hitherto generally been exported; but matters in this respect have fortunately become somewhat easier.

INCREASES IN THE PRICE OF GAS.

The whole of the bye-products of gas-works had by the end of the year 1914 declined in value; and this, combined with the increased cost of coal and all other materials and charges, made it imperative, with few exceptions, to increase the price of gas—always a disagreeable duty for both municipal committees and company directors. The increases in the North-Eastern district range from 2d. to 8d. per 1000 cubic feet.

COAL.

The increased price of coal has perhaps, in the majority of gas undertakings, been the most serious difficulty with which their administrations have had to contend. Fortunately, twelve months supplies had been purchased generally before the outbreak of war; but the trouble arose in the early months of the present year when a coal boom commenced, and all purchases for delivery during the following twelve months were subject more or less to its effect. Durham coal—which could have been purchased in January last for prompt delivery at about 11s. per ton f.o.b. Tyne—was towards the end of February most difficult to obtain, owing to the abnormal demands from other countries. Prices soared rapidly, until ultimately they reached the staggering altitude of 27s. per ton in the month of April, with every appearance of rising higher. The prospect for the future to all large consumers of coal was so serious that a conference of about 600 representatives of gas, electricity, and other undertakings was held in London, in May, to consider what steps should be taken to meet the situation; for most gas undertakings had already been obliged to raise the price of gas, and unless matters improved many would have to resort to further increases.

The conference appointed a strong deputation to lay the facts before members of Parliament, with the result that the Government were informed of the serious position of the undertakings; and they promptly took the first of two steps to alleviate the situation by the appointment of a Coal Export Committee, with powers to restrict all exports, by making it necessary to obtain licences before shipment to neutral countries. The effect of the operations of the Committee was soon apparent by the greater quantity of coal available for home consumption, and a consequent fall in prices. The Committee have since drawn the strings more tightly by a further regulation extending the requirement of licences for all coal exports to our Allies.

The second step was the passing of the Price of Coal (Limitation) Act, 1915, which received the Royal Assent on July 29, and thereupon came into operation, and will continue during the continuance of the war and for a period of six months thereafter. The effect of the Act briefly is that during the prescribed period the price of coal at the pit mouth (not being for exportation) shall not exceed the price at which such coal was sold under similar conditions on or near the corresponding date in the twelve months ended June 30, 1914, *plus* the sum of 4s. per ton. The Act contains a useful provision in favour of statutory gas and electricity undertakings with respect to contracts made between the 1st of April and the commencement of the Act at higher prices than the maximum.

The first action of the Government therefore restricts the excessive shipment of coal abroad, which was the main factor in running-up prices; and the second provides, when a purchase of coal is desired, a method of fixing a maximum price based upon the actual prices of the twelve months ending June 30 in the year immediately preceding the war. So far the action of the Government has been beneficial to purchasers. Not only has the upward trend of prices been arrested, but they have been materially reduced. For this relief gas undertakings appreciate the action of the promoters of the weighty conference which moved the Government to take prompt action to relieve a most critical position for those bodies whose duty it is, under statutory compulsion, to supply the public with commodities of such general necessity to the nation as gas and electricity, and especially so during the war, when such supplies are increasingly important.

As to whether or not the measures of the Government will be sufficient for the full attainment of the objects in view, it is, of course, impossible to say with any certainty. I am, however, of opinion, that the operations of the Export Committee, properly carried out—as we may assume they will be—will result in the prevention of prices being abnormally inflated, as the control by the Committee over shipments abroad will, while providing for the necessities of our Allies, prevent neutral countries obtaining such quantities as would leave a shortage for home consumption; and the Coal Prices Act will also assist—at any rate, the purchasers know the worst. Prices cannot exceed the range existing during the basis twelve months, *plus* 4s., which represents the extra cost of the colliery due to the war; and how much lower coal may be obtained at depends upon the measure of the restrictions of the Coal Exports Committee. I would, however, add that we cannot easonably hope to obtain coal during the war period at peace period prices.

THE GAS INDUSTRY AND ITS ASSOCIATIONS.

It is a matter for congratulation that the gas industry of the country is in as vigorous a condition as it has ever been in the past. A few years ago, perhaps, this could not have been said. Serious competition was a new experience for us; and some time was needed to realize that this cannot be taken lying down without osing position in the battle, and that competition calls for more energetic effort upon the part of all those who desire to succeed. Gradually, however, competition has proved to be the necessary stimulus for arousing us to the need of greater and greater exerion. Organization was already existing, but required development. First in rank and length of days was the Association now known as the Institution; then the District Associations, which have provided further means for the discussion of the problems of the industry with the very important advantage of seeing them from a local point of view. I would here add that at the first meeting of our own Association (38 years ago) the first President—the late Mr. W. J. Warner—clearly recognized the importance of the business side of the gas undertakings; for he said, when referring to the future work of the newly-established Association: "The papers therefore of the commercial portion of our business should be as carefully prepared as the professional; and in their discussion there should be a deep sense of responsibility of our individual positions. Ours is not a private business, it must always be borne in mind, and also that the public have a pecuniary interest in our undertakings. It is a matter of regret, I think, that such Associations as ours were not established at an earlier period of our history, as they would have advanced our business, and, by the diffusion of information, have materially improved our relations with consumers individually and collectively." These words, uttered so long ago, will, I am sure, be endorsed by all our members to-day.

Next in order came the Commercial Sections, which might, in some instances, be more appropriately otherwise named; for matters other than "commercial" relating to gas-works management are also dealt with. The usefulness of these sections cannot easily be over-stated. The monthly meetings of the heads of the administrations of the undertakings of a district afford opportunities for the discussion of subjects with greater freedom than is the case in the more dignified meetings of the larger bodies, with generally so full an *agenda* that a new subject cannot easily be interpolated. Then there is the Society of British Gas Industries, which contributes so largely to the welfare of the industry by providing the latest and best in the way of plant and appliances for both the manufacture and use of gas. And, finally, the British Commercial Gas Association, brings practically the whole industry together through representatives from all the districts and from the Society of British Gas Industries.

The whole of these Associations afford opportunities for frequently conferring as to the multitudinous matters that concern the welfare of the industry in which they have a community of interests. This organization of the industry has brought about what I may call a new spirit among us—that of a greater willingness on the part of all to co-operate for the purpose of carrying out our obligations to our customers, the public, in such a manner as to render it the most efficient service within our power to give; for therein lies the secret of the success of the industry.

The Sulphate of Ammonia Association, although it does not come under the above enumeration of the various details of the organization of the gas industry, is nevertheless a body in which the gas industry is largely interested; and it is a very valuable Association for the purpose of enlarging the use of this fertilizer throughout the world by means of propaganda, and for assisting in the disposal of the largely increasing production thereof. Mr. A. G. Leighton, the Home Sales Manager of the Association, will to-day give us some information as to the efforts now being made to assist in the greater use of the article in the British Isles.

I think you will agree, therefore, that the industry we represent is fully equipped for the maintenance of the progress which it at present enjoys.

USES OF GAS.—VALUE OF SHOW-ROOMS.

Gas is used so extensively for purposes other than the original one when, a century ago, it first entered in the homes and business premises of the people as an illuminant, that it has almost literally laid successful claim to have "a thousand and one uses;" and these are increasing as the value of heat under perfect control is realized. That it is being so realized is demonstrated by the use of it during the present period of unexampled exertion in our industrial areas.

The consumption of gas continues to make steady and substantial progress, as the Board of Trade and other statistical returns bear ample witness. The introduction of vastly improved lamps and burners—more particularly the "Metro" introduced by the South Metropolitan Gas Company—has had a beneficial effect in increasing the use of gas for lighting; and the hiring of cookers, fires, and water-heaters has also greatly increased its use. This is, of course, very satisfactory; but for the gas undertakings that supply areas in which there are industrial manufactories, there is very fruitful field for the introduction of gas-heated furnaces and other appliances, where heat under perfect control is essential and can be provided by gas economically. In such districts it is very desirable to provide a well-fitted industrial show-room for giving practical demonstrations. A conservative estimate, made a short while ago, showed that about 750 million cubic feet was then used in the Newcastle Company's area for industrial purposes (including about 500 gas-engines, but not the lighting of factories), or nearly a quarter of the total consumption. This will be more at the present date.

The price charged for gas for industrial purposes (other than that used in gas-engines which is subject to a discount of 25 per cent.) is the same as for other purposes, and subject to the same scale of discounts—viz.:

Consumption per Quarter.	Discount.		Net Price, with Gas at 2s 3d. per 1000 Cubic Feet.	
	Per Cent.		s.	d.
000 to 100,000 cubic feet . . .	10	..	2	0·3
100,000 to 250,000 cubic feet . . .	12½	..	1	11·625
250,000 to 400,000 cubic feet . . .	15	..	1	10·95
400,000 to 1 million cubic feet . .	17½	..	1	10·275
1 million to 15 million cubic feet .	20	..	1	9·6
15 millions to 80 million cubic feet.	22½	..	1	8·925
80 millions upwards cubic feet . .	25	..	1	8·25

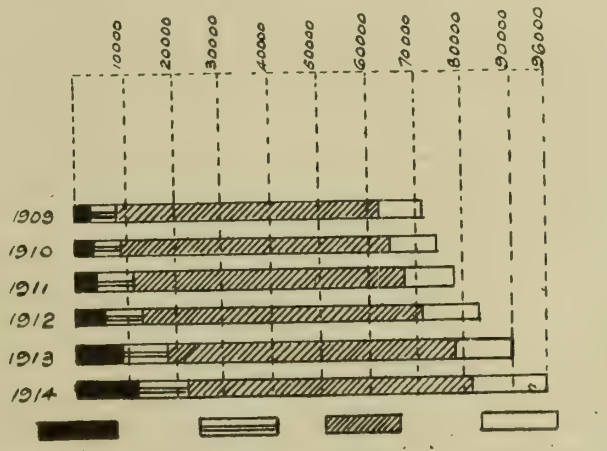
The question of a differential price for furnaces and such like appliances is one that presents some difficulty in drawing a line as to classes of consumption; but it is one of those matters which will need to be determined "after the war." The use of industrial appliances undoubtedly favourably affects the day as well as the summer consumption.

GROWTH OF DOMESTIC GAS APPLIANCES.

The following table shows the growth of the number of cookers, fires, &c., issued on loan during the past five years, which covers the period of the special efforts of the Newcastle Company to develop these portions of the business and the propaganda work of the British Commercial Gas Association.

	1909.	1910.	1911.	1912.	1913.	1914.
Cooking-stoves on loan—						
Ordinary . .	9,395	9,837	10,105	11,248	12,555	14,101
Prepayment .	53,450	55,390	56,956	57,948	59,133	59,961
Grillers on loan.	6,002	7,329	8,076	8,792	9,282	10,152
Gas-fires on loan—						
Ordinary . .	2,436	3,106	4,137	6,028	8,929	11,528
Prepayment .	86	107	150	266	393	493

The following shows these figures in diagrammatic form:



For the purpose of the development of the use of gas, the Company have three show-rooms—one in the same building as the chief offices, another in Northumberland Street [a good thoroughfare for the purpose], and the third in the adjoining borough of Gateshead. The Company's area is divided into four districts, each being in charge of a district representative (with one or more assistants) responsible for the conservation and development of business within his district; the whole of the Sales of Gas Department being under the superintendence of a competent chief. It is a system which works very satisfactorily.

COKE DISPOSAL.

The problem of the profitable disposal of coke has of late seriously grown in importance, owing to increased coal carbonization [and this notwithstanding the increased makes of gas per ton] and the greater production of coke per ton of coal carbonized. In addition to these causes, the rise in the price of oil has resulted in less oil gas being made throughout the country, and consequently leaving more coke to be disposed of. Stocks increased enormously early last year; but circumstances connected with the war have relieved the situation up to the present time. We may, however, anticipate that there will be an increasing necessity in the future for finding new outlets for this bye-product.

The difficulty being a national one, the finding of the remedy appears to be a suitable one for united effort; and appropriately the British Commercial Gas Association have taken the lead by forming a Coke Committee, and issuing a report upon the subject of the means for improving sales, and have also provided suitable literature and advertisements for publicity purposes. It remains for the undertakings to prosecute the work individually in their respective districts, in the manner most suitable to the conditions thereof; for naturally the conditions vary largely. Those in the North of England have, for instance, to take into consideration the close proximity to comparatively cheap coal. In some towns

EXPRESS COKE DELIVERY WAGGONS.

in this district the make of coke is larger than the towns can absorb at a reasonable price; others, again, are so geographically situated that they have an outlet, through ports within a reasonable distance, for the exportation of the surplus remaining after their own district has been supplied. I would say here that such surplus should not be dumped into a neighbouring district unless there is a shortage in that district, and then by arrangement with the undertaking of that area.

The Newcastle Company have for nearly half-a-century been obliged to export their surplus coke, and have, consequently, built up a connection for its disposal overseas. They have, however, been careful to avoid penalizing the home consumer thereby; the price charged to the latter being regulated by that charged by neighbouring undertakings. But whatever may be the conditions of a gas undertaking regarding outlets, its duty, and also its interest, appears to be in securing within its own area a steady and permanent business for coke to be consumed in the district.

The Directors of the Newcastle Company determined, in September last year, to make a further effort to increase the sale of coke for use within their area of supply; and during the twelve months just completed they have reason to be satisfied with its success, notwithstanding very serious interruption to sales during the last winter, due to the impossibility of delivering coke within many weeks of the receipt of orders, owing to the shortage of horses, carts, and drivers, and the commandeering of the motor coke waggons by the military authorities.

The following statement will show the comparison of the disposal of coke for the twelve months ended September, 1914 and 1915 respectively:—

Disposal of Saleable Coke

(Exclusive of used on works and breeze).

Twelve months ended September.

		1914.		1915.
Total saleable . . .		151,429		152,036
Used on carburetted water-gas plant . .		1,755 (1·1 p. ct.)		3,951 (2·6 p. ct.)
Land sale—				
Carted . .	27,254		34,402	
Rail . .	8,388		11,077	
Craf . .	1,934		1,012	
		37,576 (24·9 p. ct.)		46,491 (30·6 p. ct.)
Exported		112,098 (74 p. ct.)		101,594 (68·8 p. ct.)
		151,429		152,036

Increase, 8915 tons (21·1 per cent.) on land sales.

POPULARIZING THE USE OF COKE.

The means adopted for popularizing the use of coke were briefly as follows:—

1.—Reduction in price from 16s. 8d. to 14s. 7d. per ton [this would have been reduced in any case to 15s.], broken coke 10d. extra. The latter does not cover the cost of breaking; but, by the introduction of new coke storage, grading, and screening plant at Elswick, the quantity necessary to put through the breaker is considerably reduced.

2.—Provision of a number of one-ton motor coke delivery waggons to expedite delivery.

3.—Enlarging the area of a uniform charge for delivery. The motors enabled this to be done.

4.—In addition to selling coke in 1 cwt. bags, the introduction of paper bags containing 28 lbs. This resulted in the sale of 80,975 bags, with an aggregate total weight of 1012 tons, and were distributed in certain districts by shopkeepers.

5.—Advertising by means of the press, posters, literature, and distribution of coke-order cards. This portion of the scheme has not been carried out as fully as was intended, owing to the difficulty as to deliveries of coke.

6.—Appointment of a representative to develop coke sales, the results of which so far have been exceedingly satisfactory. But here, again, the war has interfered with the work; for within a few months of his commencing duty he joined the Colours.

The promising measure of success gained I attribute mainly to the increase of facilities for supplying coke cheaply, expeditiously, and with the minimum of trouble to the consumer.

The number of express motor delivery waggons now employed in the delivery of coke is twelve. Ten of these are shown in the accompanying photographs, as is also a portion of the coke-handling plant, further particulars of which will be found in Mr. Hardie's interesting account of the partial reconstruction of the Elswick Gas-Works.* The usefulness of the "Express" waggons is most marked on the occasion of a sharp fall in temperature in winter, when the orders for coke arrive in large numbers. I am confident that their introduction has materially assisted us in the development of the sales of coke, and will continue to do so still more as the system is still further organized. The coke-waggons used for coke conveyance were made by Messrs. Sir W. G. Armstrong, Whitworth, and Co., and are 15/20 H.P. The chassis is of the Armstrong-Whitworth type, with worm gear and specially strengthened back axle. The body is made of pitch pine 6 ft. 6 in. by 6 ft. 8 in. by 2 ft. 9 in. deep, fitted with special tipping gear enabling the whole of the load to be discharged freely. The waggons carry 20 cwt. of coke easily, on pneumatic oversize tyres, 820 m.m. by 135 m.m. The average quantity of coke carried per waggon daily is 10 to 11 tons; and the average daily mileage is 40 to 50. But it is possible, under good conditions, to do 14 to 15 tons, and 60 to 70 miles per day.

THE "B.C.G.A."

The British Commercial Gas Association continues to command the support of the gas industry, as it deserves to do. As time passes it enlarges its activities for the benefit of all concerned in the production and distribution of gas—whether members of the Association or not—and will persevere in doing so until 100 per cent., and not 80 per cent., of the undertakings are subscribers.

Mr. W. Doig Gibb moved a vote of thanks to the President for his address, which he said they had listened to with great interest. It was really very difficult to say anything new in presidential addresses, but he had been very glad to come North to hear the one they listened to that afternoon. Mr. Waddom was still the original man he had always been, and he had given them some-

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* See *ante*, p. 20.

WAGGONS IN POSITION FOR LOADING.

hing that was quite out of the ordinary run of presidential ddresses. It was the sort of address they might expect from Mr. Vaddom; they had got something good. Mr. Waddom had done great deal for the gas industry in the North of England, and he ad long been connected with the Newcastle and Gateshead Gas Company. This connection had resulted in much of the success vhich attended the Company's operations to-day. He took a ceen personal interest in the North of England Gas Managers' Association, and the interest he took in the gas industry nationally was evidenced by what he had done in connection with the advocacy of the claims of the British Commercial Gas Association.

Mr. M. Fligg (Redcar) seconded, and said Mr. Waddom had given them a very good address, which would encourage them to further efforts on behalf of their respective gas undertakings. Mr. Waddom was always willing to give them the benefit of his long experience and knowledge of gas affairs. He had done splendid work in their Commercial Section. They always looked upon the Newcastle Company as the leading gas company in the North of England, and had admired its progressive policy.

The resolution was cordially agreed to.

The President briefly returned thanks. He assured them that what they had said was perfectly true; his heart and soul were in gas. His only regret was that the heart was not so strong as it was, for they must always remember the limitations which *Anno Domini* placed upon them. It had been a most difficult thing in addressing them to avoid repetition. There were a good many subjects he would like to have touched upon, but he found it necessary to keep a lot out; and what little merit the address possessed had been to him a labour of love.

Calorific Value and Calorific Standards.

Mr. J. T. Dunn, D.Sc., then read a paper on "Some Considerations as to the Calorific Values and Calorific Standards." This will be found, together with the discussion upon it, on p. 34.

Home Sales of Sulphate of Ammonia.

Mr. A. G. Leighton, of the Sulphate of Ammonia Association, next read a paper on this subject. It was on the lines of that contributed by Mr. F. C. O. Speyer to the North British Association last month [see "Journal" for Sept. 7, p. 512]. At its close,

The President said he thought they would be all pretty well in agreement with what Mr. Leighton had said. He might say he was. They could not do better than cultivate home sales. Example was better than precept; and his Company had for many years set the example. They had cultivated home sales until they had got a secure market. The local use of sulphate of ammonia was equal to almost a third of their entire make. It took more to sell it than giving it to a man to go abroad, but it was worth doing. The more they sold locally or in the home country, the better would be the price for export. They could not in this little country use all the sulphate of ammonia they made; and some, therefore, would have to go abroad. As to the terms for home sales, he certainly agreed to the equity of those proposed by Mr. Leighton. In proof of this, he might mention they were the same as his Company had used for the last ten or twelve years. It amounted to within a fraction of 10s. per ton.

Votes of Thanks.

Mr. R. Nelson (Hull) moved a vote of thanks to the readers of the papers and to Mr. T. Hardie for his description of the Elswick Gas-Works and to the Directors and Officials of the Newcastle and Gateshead Gas Company for their hospitality. He said it had been a privilege to them to see the work of reconstruction which was being carried out at Elswick, and to most of them the visit had been all too short. Given a convenient site, it was a comparatively easy matter to put down new works; but Mr. Hardie had been faced with the problem of demolishing old works and putting down new works in their place. He congratulated Mr. Hardie upon the reconstruction of the works, and thanked him for the opportunity of having seen and heard how the various difficulties had been overcome.

Mr. Norman S. Cox (Sunderland) seconded the proposal, and said the papers had been most interesting.

The votes of thanks were warmly accorded.

Mr. Dunn, in reply, said the visit to the Elswick Gas-Works had been exceedingly interesting.

Mr. Leighton, in responding, said he was very pleased to have had the opportunity of bringing the work of his Association before the members of the Association.

Mr. Hardie also briefly returned thanks.

Members with the Forces.

The President said he would like to introduce a matter that was not on the *agenda*. The Association, as they knew, had a number of members and associates who were serving their country under the Colours, and some of them were at present in the fighting line. He suggested it would be an encouragement to those members if the meeting passed a resolution expressing appreciation of their patriotism. He therefore moved the following resolution:

> That this meeting records with gratitude and pride that many of the members and associates of the North of England Gas Managers' Association are serving their country patriotically in defence of the Empire, and expresses the sincere hope of all present that each and all of them may have good luck and a happy return to the North of England.

Mr. T. H. Duxbury (South Shields) seconded the proposal, and it was agreed to.

The members and their friends were afterwards entertained to tea by the Newcastle and Gateshead Gas Company; and subsequently Sir Walter R. Plummer, the Deputy-Chairman of the Company, who was unfortunately late in arriving at the business meeting, owing to his train from Keswick being delayed, took the opportunity of welcoming the members on behalf of the Directors, and duly acknowledged the vote of thanks that had been passed earlier in the day.

Mr. G. J. Eveson, the Governing-Director and Founder of the G. J. Eveson Coal and Coke Company, Limited, of Birmingham, whose death occurred last June, left estate of the gross value of £63,005. Among his bequests he left £1 for each employee in the Company for each year of service up to twenty years.

SOME CONSIDERATIONS AS TO CALORIFIC VALUE AND CALORIFIC STANDARDS.

By J. T. Dunn, D.Sc., F.I.C.

[A Paper read before the North of England Gas Managers' Association, Saturday, Oct. 2.]

When my old friend Mr. Waddom asked me to write a paper during his presidency on the question of statutory calorific standards for gas, I could do no other than consent, although I felt there was nothing new to be said on the matter. I can only hope that the reiteration in other words of what has already been said may not weary you, and that perhaps progress may be helped, not only by new contributions to the question, but by the increase of the volume of expressed opinion.

Gas undertakings, being monopolies, have always been subjected to statutory restriction and regulation; and because their product was used solely for producing light, the test imposed on them was one of illuminating power. For many years the No. 1 "Argand" burner was prescribed for the test; and 16-candle gas was the usual standard. But altered conditions of manufacture, the use of higher temperatures to produce higher yields of gas, the difficulty of obtaining high-grade coals, tended to lower the quality of the gas as an illuminant, and it was felt that the No. 1 burner dealt unfairly with these poorer gases. In burning gas in an argand burner, the luminosity depends on the ratio between gas and air; and if we shut off the air almost completely till the flame smokes, then gradually admit more, we shall see the luminosity increase up to a certain point, just after the flame has ceased to smoke, then gradually diminish, till, if we can introduce enough air, there will be hardly any light at all, and we shall approach the condition of things in a bunsen burner. The No. 1 argand, in which the gas was to be burnt at a fixed rate, and in which the air supply could not be regulated, burnt 16-candle gas to fair advantage, but carried too much air for a poorer gas, and hence unduly decreased its luminosity. This could be partly remedied by burning the gas at an increased rate (which does not correspondingly increase the air), and calculating to the standard rate the luminosity so obtained. But a better plan, and one of use over a wider range of quality, is to keep the gas-rate constant, and regulate the air to get the highest luminosity. This is the plan adopted in the No. 2 burner, which is now the recognized burner for official tests of luminosity.

The following figures are instructive, showing as they do the luminosity of four samples of gas, each tested by the No. 1 burner at 5 cubic feet per hour, also at such a rate as to fill the chimney with flame and thus get the best effect out of the burner, and by the No. 2 burner.

No. 1, 5 cubic feet . . .	13·1	13·4	13·1	12·8 candles.
No. 1, best effect . . .	14·9	15·05	15·4	15·6 ,,
No. 2, 5 cubic feet . . .	17·5	17·5	18·0	17·8 ,,

They illustrate very well the dependence of the result upon the conditions of the experiment, and even when the conditions are prescribed—as in the London Gas Referees' instructions—the result is dependent on the very closest adherence to those conditions, and may be affected by circumstances not prescribed—like the pressure, the humidity, or the composition of the atmosphere in which the test is carried out.

However unsatisfactory a luminosity test may be, as long as luminosity was the only valuable characteristic of gas, such a test, carried out with as high a degree of accuracy as practicable, was obviously a reasonable and even a necessary thing. But at the present time, when a very large proportion of the total make of gas is used for heating and for the development of power, and when even that employed for producing light is used mainly in incandescent burners, which do not depend on the inherent luminosity of the gas, but yield a luminosity far higher than that by burning the gas so that it yields no inherent luminosity at all, we may well ask, in the language of the mathematician, whether a luminosity test is necessary and sufficient. Is the value of gas for these purposes dependent on its illuminating power, or is there any relation between that value and that power?

ENERGY DERIVABLE FROM COMBUSTION.

The heat given out during the combustion of gas is a measure of the energy derivable from the combustion; it is a fixed and definite quantity for any given gas, and tells us exactly what the value of the gas is to us, whether we use it as heat, or whether we convert it into mechanical effect or other form of energy. But the proportion of the energy which affects the eye is very small, and bears no constant relation to the total. The light we see no more represents the total energy of a burning gas than the sound we hear represents the energy of a vibrating spring. The spring may vibrate very energetically, but so slowly or so rapidly that we hear no sound. And heat may be given out from a combustible in a form not perceptible by the eye at all. The illuminating power of a gas is certainly no direct measure of its heating or energy value. Is there, however, any proportionality between them? Much work has been done on this question; and as the illuminants in coal gas have usually a higher heating value than the non-illuminants, it seems at first that illuminating and heating values should go up and down together, and that the luminosity test might also serve as an index to, if not a direct measure of, the heating value. This position was taken up by Mr. Grafton at Glasgow last year; but his figures show that it is only true to a limited extent, with gases of the same origin and generally similar composition. A carburetted water gas of 18 candles had a calorific value of 489 B.Th.U., for example, while a coal gas of only 16·5 candles had a calorific power of 580 B.Th.U.

We may take it, then, that for the purposes of heating and production of power, as well as for lighting by incandescent mantles, we ought to have a knowledge of the absolute number of heat units derivable from a cubic foot of the gas we are using. This can be done in two ways. We may analyze the gas, and calculate the calorific value from this analysis and from the published calorific values of its constituents, which have been determined with very great care, or we may determine it experimentally, with one of the excellent instruments which have been devised for the purpose—such as the Junkers' or the Boys' calorimeter. There is no question the latter is the more rapid, the more convenient, and in ordinary daily work the more accurate. These are instruments in daily use; and careful experimental work with them (such as that of Mr. Coste[*] and Mr. Holgate[†]) has shown the magnitude of the errors involved through differences between the temperatures of the ingoing gas and air and the outcoming products of combustion, variations in the humidity of the atmosphere, in the temperature (and thus the density) of the collected water, and so forth. The outcome of all this is that with these instruments the calorific value of any gas can be determined with a very satisfactory degree of accuracy.

In speaking of the accuracy of measurement, one ought to draw attention, perhaps, to the conditions of measurement in distributing gas. A consumer in Alston or Consett, for example, where the barometer is, roughly speaking, an inch lower than it is in Newcastle, may be getting a gas giving exactly the same number of B.Th.U. per cubic foot at 60° Fahr. and 30 inches barometer, as the gas at Newcastle; but every thousand cubic feet he buys only contain about 29-30ths of the actual amount of gas which the Newcastle consumer gets for 1000 cubic feet. Again, if we assume that our gas is always saturated with water vapour, the consumer at any place on a hot summer day with the thermometer at 75° Fahr. is only getting about 92 per cent. of the gas he will get in winter—or shall we say spring—with the thermometer at 40° Fahr., for the same registration on his meter.

GROSS AND NET CALORIFIC VALUES.

It would be superfluous to describe these calorimeters or their working; but I should like to refer to two points in this connection. The first is the difference between the "gross" and the "net" calorific value. As is well known, the gross or total heat value is the amount of heat given off by the combustion of the gas, starting with the gas and air at a given temperature—say 60° Fahr.—and ending with the products of combustion at or near the same temperature. This involves the condensation to water of the steam formed by the combustion of all the constituents of the gas which contain hydrogen, and the cooling of this water, with the other products of combustion, to the starting temperature; and it is, for the same gas, a perfectly definite figure. The net value is obtained by determining the amount of water formed during the combustion, and deducting from the gross value the amount of heat which this water evolved in condensing to water from steam measured at 212° Fahr., and in cooling from 212° to the initial temperature.

Now this is a perfectly arbitrary figure. It is often said that it is of use, because we do not, in the practical usage of gas (or of any other fuel), cool the products to atmospheric temperature. But neither do we let them go always at 212° Fahr., nor do we let the steam go at this temperature and treat the other products differently. The whole of the products escape at the same temperature, whatever that temperature may be. The net value does afford a means of comparing gases having similar gross values but differing in their hydrogen content; and the determination of the amount of water formed allows us to calculate, if we wish, the amount of this hydrogen. But it does not measure for us the amount of heat available under the actual conditions of ordinary combustion, to calculate which we must know these conditions and the composition of the gas, and thence calculate the amount of heat carried away in the products of combustion.

Take, for example, the following gas, averaged from four samples of coal gas quoted by Mr. Coste in his paper, and for which I have calculated the amount of air needed and the volume of the products of combustion of a cubic foot:—

	Cubic Feet.	Air Needed.	CO_2	Steam.	Nitrogen.
H_2 .	0·462	1·109	—	0·462	0·878
CH_4 .	0·332	3·187	0·332	0·664	2·523
C_3H_6 .	0·037	0·800	0·111	0·111	0·633
CO .	0·082	0·197	0·082	—	0·156
CO_2 .	0·020	—	0·020	—	—
O_2 .	0·005	—	—	—	—
N_2 .	0·061	—	—	—	0 061
	0·999	5·293	0·545	1·237	4·251
Less in gas		0·025			
		5·268			

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[*] "Journal of the Society of Chemical Industry," Vol. XXVIII., p. 1231.

[†] "JOURNAL OF GAS LIGHTING," Vol. CIX., p. 355, and *post*.

he calorific value as determined was : Gross, 596 B.Th.U.; net, 3 B.Th.U.

Now suppose all the products are to escape at 212° Fahr., we ust subtract from the gross value the amounts of heat needed to ise from (say) 60° to 212° Fahr. the gaseous nitrogen and carbon oxide and the liquid water, and to vaporize this water at 212°. 'e shall find these amounts to be 11·61, 2·08, 9·1, and 58 B.Th.U. spectively. If we subtract the sum of the last two, 67·1 from 596, e get the calculated "net" value, 528·9—not very different from ie determined 533. But for the actual heat available in the cir-umstances, we must subtract the total of the four, 80·8; leaving a "available" calorific value of 515·2. If the products are to scape at 302° instead of at 212° Fahr., we shall, further, have to educt the heat needed to raise the nitrogen, carbon dioxide, and eam through 90°, which will come out at 10·7 B.Th.U.—leaving r available heat, 504·5.

And, if instead of supposing that only the air needed for com-ustion is present, we assume that half as much air again is there s excess air, which is a very reasonable assumption, we must rther deduct the heat needed to raise this air to 212° or 302° 'ahr., which is 7·2 and 11·5 B.Th.U. respectively—reducing our vailable calorific power to 509 when the products leave at 212°, nd to 493·1 if they leave at 302°. Any one of these figures may e called a "net" value for a particular set of circumstances; but here can be for a given gas only one gross or total value.

The second point is a related one. If we are using our gas to oil water, for instance, the value of a given gas will be directly s its calorific power; and it will be indifferent to us whether we erive 600 B.Th.U. from one or from two cubic feet of gas, if the econd gas is half the price of the first. But to heat an incandes-ent mantle, or for other work involving high temperatures, the lame temperature is important; for as we raise the temperature f the mantle we increase the luminosity in a still greater degree. Now flame temperature depends, not only on the amount of heat iven by a cubic foot of the gas, but on the amount of material n which the heat has to spend itself—that is to say, on the mount of the products of combustion. We must regard not only he gas as generating a certain amount of heat, but the amount of xygen which is necessary and which shares in the generation of heat, and, further, the quantity of nitrogen associated with the oxygen, and the amounts of carbon dioxide and water produced.

The following figures, relating to the combustion of a cubic foot f each of the ordinary constituents of coal gas, will show this:

—	Air Needed. Cubic Feet.	B.Th.U. (Products at 212°) per Cubic Foot of		Volume of Products.		
		Gas.	Mixture.	Steam.	CO_2.	Nitrogen.
H_2 . .	2·4	263	77·0	0·5	..	1·9
CH_4. .	9·6	875	82 4	2·0	1·0	7·6
C_2H_4 .	14·4	1433	93·0	2 0	2·0	11·4
C_3H_6 .	21 6	2102	93·0	3·0	3·0	17·1
C_6H_6 .	36·0	3448	93·5	3·0	6·0	28·5
CO . .	2·4	312	91·7	..	1·0	1·9

We see from this that while there are enormous differences in the calorific values of a cubic foot of the different gases, yet the differences in the calorific values of a cubic foot of the mixtures which are required for complete combustion—and which are really the things we have to compare—are very small. And if, from the capacities for heat of the various gaseous products and the available heat of a cubic foot of each mixture, we calculate the temperatures to which this heat could raise these products—which, from want of trustworthy experimental data, we can only do roughly—we shall find that these "maximum flame temperatures" so obtained do not differ very considerably, but that the gases of lowest calorific value (hydrogen and carbon monoxide) give the highest values, and hence may be regarded as preferable, from the point of view of incandescent lighting, to gases of higher calorific value. Not, of course, that they would be worth more per cubic foot, but that a given number of British thermal units conveyed by their means would have advantages over the same number of British thermal units conveyed by means of one of the other gases.

In view of all this, it appears that—not accurately, but approximately—the value of a cubic foot of gas is proportional to its calorific power, but that, within reasonable limits, if we can supply to a mantle per second a certain number of B.Th.U., it makes little difference whether these are furnished by a small volume of rich gas or a larger volume of poorer gas, since equal volumes of the mixture in either case, in contact with the mantle at a given moment, carry not very different quantities of heat. So far as there is a difference, it is in favour of gases containing considerable proportions of hydrogen or carbon monoxide.

If, then, the question is put whether gas undertakings, having to satisfy statutory requirements, should work to a standard heating value in their gas, the answer, in view of the importance of calorific power for the uses to which almost the whole make of gas is now put, must be "Yes." And if, further, it be asked whether the test for illuminating power should be retained, the answer depends on the extent of the usefulness of such a test. Mr. Thomas Hardie, in a paper read in 1909, stated that in 1906, 93 per cent of the penny-in-the-slot consumers in Newcastle used incandescent burners, and that in Edinburgh (then supplying a 20-candle gas) the percentage over the whole of the consumers was 65, and of the artisan consumers 91. We may safely assume that to-day the number of flat-flame burners will have been much further reduced; and it would probably be a difficult matter to discover anyone using an argand burner. In these circumstances, there is practically no service rendered by the test; and it becomes a requirement purely formal, and may hamper gas undertakings and prejudice consumers, by preventing the adoption of methods of manufacture that would mean economic advantage from the point of view of calorific value.

The Standard for Calorific Value.

As to what figure should be adopted for the standard of calorific value, I do not feel competent to speak. I will only point out that, as we have seen, there is no very striking advantage in having a gas of very high calorific value (unless, of course, its cost is at the same time going to be low); but for all the uses of gas there is a very great advantage in having the supply regular and constant. If, then, greater control is possible over the manufacture of gas of not very high heating value, and greater constancy of quality can be attained than with a richer gas, then with the poorer gas rests the greater economy provided cost per B.Th.U. be not in favour of the other. What quality of gas is most economically producible, it would be presumption on my part to say. But the experimental work of the German gas engineers has at any rate shown that as the temperature of distillation is raised, and the yield of gas increased, though the illuminating power and the B.Th.U. per cubic foot are decreased, yet a larger proportion of the total heating value of the coal is found in the total make of gas. But whatever the numerical value of the standard fixed, I think gross value should be specified, whether or not there be any restriction also on the net value; because, as we have seen, the gross value is a fixed and definite characteristic of the gas, while the net value is only one of many arbitrary values, each depending on the conditions of the combustion.

A Plea for the Metric System.

There is another measure which I think would be of even greater benefit to the gas industry, as well as to the rest of the nation, than the imposition of calorific standards or the removal of illuminating ones. That is, an Act abolishing all that monstrous "concatenation of absurdities" which, with unconscious irony, we call the British "system" of weights and measures—an Act to throw hundredweights and tons, and feet and inches, quarts and gallons, poles and perches, bushels and acres, drams, scruples, hogsheads, pecks, and all the rest of the crew, upon a common scrap heap, and burn or bury them, and to give us the metric system for our use. I fear we are not likely in the near future to see such an Act passed, though it would be one of the most useful steps possible in the direction of capturing German trade, of whichwe hear so much nowadays. But we can surely at least ask that the metric system shall be kept clear of our insular confusion; that calorific standards shall be expressed either in British or in metric units but not in both; and that such barbarisms as 125 calories per cubic foot shall not be permitted to occur in future.

DISCUSSION.

Mr. Charles Wood (Bradford) said their best thanks were due to Mr. Dunn for his paper. They were practically in agreement with what the author claimed as to the absurdity of expressing the heat value of gas in net units. Mr. Dunn's view was quite sound. He had never heard the matter put more clearly. It had always seemed to him absurd to talk about net calorific power. It all depended upon the purpose to which the gas was to be put, as to what they got out of it. He never used net figures; the gross figures certainly sounded better and looked better. Why should they tell people they were supplying 500 B.Th.U. gas, when they knew the aggregate was 530 or 540 gross. They never talked about net figures in his district. Of course, at the present time he did not think they were likely to be worried in any way with legislation defining it; and probably before they could get an Act of Parliament doing away with the illuminating power tests, many other circumstances might have occurred. He was quite sure the best gas to be supplied, as the author of the paper said, would be that which they could produce most economically whatever quality it was, whether it was 500, 400, or 300 B.Th.U., or perhaps even less. It was a subject about which they had not been thinking much recently. Many of them were having to supply, or were supplying, gas of lower calorific power than before the war. He had heard only that week, on the best authority, of a gas which was being supplied of which he did not know the calorific value; but in a flat-flame burner it gave absolutely no light at all. In case any of them thought it was his neighbour, he might tell them that it was a gas that was being supplied in Berlin. He did not think they would quite get down to that in this country. He had listened to the paper with great pleasure, and thought it was one which could be carefully studied afterwards.

The President said that after the remarks of Mr. Wood, there was not much left to be said on the subject. He was going to say it was a burning question to many of them, and would continue to be until some of the absurd restrictions were removed by Act of Parliament. There were a good many anomalies which could be easily removed. They were all agreed as to their lack of necessity; all they wanted was a push in order to fairly set them going.

WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.

Half-Yearly Meeting at Caerphilly.

It may confidently be asserted that not one of the members of the Institution present at the meeting which was held at Caerphilly last Wednesday regretted, when the day was done, having undertaken the journey; for the programme drawn up, in its fulfilment, proved in a high degree interesting. The time set aside for the business meeting was, indeed, as the event showed, much too short for all that there was to be said on the different subjects introduced; but this was not in any way prejudicial to the after-proceedings. Luncheon, on the invitation of the Chairman and Directors of the Rhymney and Aber Valleys Gas and Water Company, was none the less enjoyable from the fact that the visitors had waited for it somewhat beyond the appointed hour; and the inspection of the new gas-works now in course of construction, and the stately Castle ruins, as well as the subsequent tea as the guests of the Company, were thoroughly enjoyed. The invitation to visit Caerphilly arose, of course, from the fact that the President of the Institution, Mr. A. W. Branson, though now occupying the position of Engineer and General Manager to the Hartlepool Gas and Water Company (in succession to the late Mr. Thomas Bower) was, at the time of his election to the chair, in May, 1914, Engineer to the Rhymney Company. He thus had the somewhat unique experience last Wednesday, as was remarked at the luncheon, of "being shown round the works that he had so largely designed and had had so big a hand in constructing," by Mr. J. P. Jones (the General Manager and Secretary) and Mr. B. Grainger (the new Engineer). As for the technical business, it will be seen that Mr. Branson's unavoidably postponed Presidential Address proved quite worth waiting for, and was well discussed, as was also a paper by Mr. F. C. O. Speyer on "Home Sales of Sulphate of Ammonia." With the weather kind, and such good "fare" provided, the meeting could hardly have been other than the success it was.

The Meeting was held in the Offices of the Gas and Water Company, St. Martin's Road, Caerphilly. Mr. A. W. Branson, of West Hartlepool (the President), occupied the chair; and there was a good—under the prevailing conditions, it may be said to have been a very good—attendance of members.

Confirmation of Minutes.

The Hon. Secretary (Mr. Octavius Thomas, of Pentre) read the minutes of the previous meeting; and they were confirmed.

New Member.

On the proposition of Mr. Thomas Canning (Newport), seconded by Mr. J. H. Canning (Newport), Mr. Ernest D. Wootten, the Manager of the Abertillery Gas-Works, was elected a member of the Institution.

PRESIDENTIAL ADDRESS.

The President then proceeded to deliver his Inaugural Address, which, owing to the circumstances then prevailing, had been postponed from the previous meeting. Certain portions of the address he regarded as particularly suitable for discussion; and he therefore invited expressions of opinions from members with regard to what he had to say.

The honour of holding the office of President of the Wales and Monmouthshire Institution is one I greatly appreciate, and is due, I feel, probably more to the goodwill of the members than any special fitness on my part. My removal to the North of England and the trying and tieing times have prevented me from fulfilling the duties as fully as I would have liked; and I am therefore indebted to the Secretary, Mr. Octavius Thomas, and the Council for their kind consideration.

THE GAS INDUSTRY IN WAR TIME.

We are again met under the circumstances of war; yet I think we may claim, without undue optimism, that the gas industry, in spite of a long list of difficulties, is so far standing the stress and strain very well, and is in addition, contributing in no mean way to the successful prosecution of the war. It has been usual on occasions like this to review, on more or less broad lines, the progress of the industry, and those methods by which it is thought further advances may best be secured. But I would more particularly allude to-day to the exceptional conditions arising out of this stupendous and awful war. At the outset, gas engineers and managers were greatly concerned as to what effect it would have on the welfare of their undertakings, and to what extent the industry generally would suffer from the dislocation and destruction which were likely to accompany the war. Now, after more than twelve months' experience, we know something of these effects, and can better judge what further may be expected, and how best to meet it.

It will be remembered that one of the first effects of the war was the sudden rise in the Bank-rate from 3 to 10 per cent. This was very disturbing at the time to those concerns working with a large overdraft. But, fortunately, it was only a very temporary condition; and the rate was quickly dropped back to 5 per cent. The moratorium, changes in currency, and the standard prices of food, steadied the public mind, and the country settled down, rather too easily perhaps, to war conditions, and talk of "business as usual" was indulged in.

The supply and delivery of necessary stores previously received from our enemies appeared at first likely to present serious difficulty; but this has been overcome almost entirely. It is to be hoped gas managers will for the future do all they possibly can to foster our independence of German and Austrian goods.

Also as affecting the gas industry, it is good to note the steps taken to make the British textile industries independent of imported dyes. I hope the same may be done in connection with the bases of drugs, so largely hitherto supplied from abroad.

Almost every article and raw material used in gas manufacture has increased materially in cost, but, with the exception of coal, not to such an extent as to cause surprise or particular criticism. It was even thought by some in the early stages of the war that the price of coal, owing to decreased consumption for ordinary manufacturing purposes, would rise very little; but in this they were sadly deceived.

COAL QUESTIONS.

Our thanks are due to those members of the industry who gave their time and influence towards obtaining the measure of relief afforded by the Coal Price Limitation Act—more particularly for the security it affords as to price for the remaining period of the war. There is still the fear as to short deliveries in the winter; and it would be a poor policy to attempt to reduce coal orders between now and the 1st of November, as some of the colliery people have suggested would be done by gas managers, in order to have a bigger balance to receive at the reduced figure.

The question of increased storage of coal has become more and more important of recent years; and every effort should be made to minimize as much as possible the disparity between winter and summer deliveries. Under statutory control as gas concerns are, in the matter of price of gas and dividend payable, it seems only right they should have some power to appeal against forced prices for coal which they cannot do without; and if this principle is established now, it may lead to some such control being later on instituted.

THE COKE MARKET.

The position of the coke market has greatly improved during the last six months; and the heavy stocks in hand which caused so much concern at the beginning of the year have disappeared. It is to be hoped this state of things will continue through the winter; for, with a shortage of labour, heavy stocks would be more than usually embarrassing. It has been suggested that Parliament having restricted the price of coal, a similar limitation should be applied to coke, and that gas undertakings are being favoured, and, as a result, are obtaining abnormally big prices for coke. The majority of gas undertakings, however, have not increased their prices for home consumption and to local consumers more than 3s. to 4s. per ton, or only about one-half the rate of increase they themselves have had to pay for coal. It is only the surplus quantities of exported coke for which anything like high prices have been charged.

GAS EMPLOYEES' RESPONSE TO THE CALL TO ARMS.

We are glad, and indeed very proud, that so many gas-works employees have responded to the call to arms—in some works as many as 30 per cent. having joined the Colours. All honour to them, and a safe return. As a result, casuals, elderly men, boys, and females have been drawn into employment. It is evident, in connection with the recent registration, that all remaining men of military age will be shortly approached and urged or compelled to enlist or go on munition work; and Government badges for strictly indispensable men have become an urgent necessity, if gas undertakings are to fulfil their statutory obligations.

When the best efforts have been made, it will mean in many places possessing the necessary plants the using of a large percentage of carburetted water gas in spite of the high prices for both oil and coke.

INCREASES AND DECREASES.

The effect of the war on the output of gas has been very marked and varied. In some cases record increases have been experienced y reason of the extraordinary supplies to the military, hospitals, nternment camps, armament works, &c.; while others, not so for- nately situated, owing to severe restrictions in public and private ghting and general economy practised by consumers, are suffer- g decreases amounting to as much as 15 to 20 per cent.

LIGHTING AGREEMENT.

The restricted public lighting has prevented the fulfilment in any towns of the conditions of lighting contracts, and led to ifferences in settling accounts with the local authorities. I think such cases if gas undertakings make an allowance for the un- onsumed gas short of the minimum stipulated in the agreement such allowance to represent as nearly as possible the actual saving nly effected by not having to manufacture the gas), they are oing all that should be expected, especially bearing in mind the creased costs since the war began, which could not be foreseen hen the lighting agreements were entered into.

CONSUMERS' ECONOMY.

I believe we may anticipate much further economy in gas con- umption by consumers. The licensed trade, for instance, are ard hit, and will certainly reduce their expenditure all they pos- ibly can, to balance their diminished income. The best way un- oubtedly to meet these temporary losses is by making special fforts to secure all possible orders for cookers, fires, and gas ppliances. It would be difficult to find a better opportunity than he present, with coal high in price and every likelihood of hortage in the winter, and in addition many people, either from hoice or necessity, will be without domestic servants. In the ase of gas-fires, although it is difficult to get canvassers, an early tart should be made, so as to ease the labour of fixing when short- anded, and also to avoid crowding the makers with orders, as hey are busy on munition work in addition to their ordinary usiness.

BOMBARDMENT AND AIR-RAID DAMAGE.

Actual damage by the enemy to gas-works has so far been con- ined to the Hartlepool works, bombarded last December; but as-mains in the street have been broken by bombs from Zeppe- ins. A gas manager on the east coast, who successfully dealt vith a broken gas-main, advises that a stock of wetted clay be kept n readiness at the works for such emergencies. A good deal can e done to extinguish the flames by standing off and throwing the lay at the main where affected.

INSURANCE RATES.

The rates under the Government scheme of insurance against lamage from air-craft and bombardment are a big reduction on hose obtainable before from Lloyd's; but I am of opinion that it vould have been fair and reasonable if all property had been sub- ect to a small war risk tax to meet these risks. As it is, the rates re such that insurance will be largely confined to the east-coast owns and places not far inland, and will bear heavily on under- akings suffering already from increased working costs and re- luced consumption.

THE OUTLOOK FOR GAS STOCKS.

Gas undertakings which have carried forward an undivided balance from year to year are now reaping the benefit of such a policy; and it is likely much more thought will be given in this direction in future. It has always been the steady dividend from gas investments which has attracted and given confidence to investors. Now this feature becomes more important still, by reason of the higher standard of values set up for capital, and a substantial sum in hand becomes a necessity, if emergencies are to be met without fluctuations in the rate of dividend.

We have seen how gas stocks have depreciated, both in the maximum-dividend and the sliding-scale companies, through the financial conditions arising out of the war; and as these conditions are likely to continue for a long time to come, it has been suggested that Parliament should be approached and applications made for powers to raise the standard price and the dividend payable in the case of sliding-scale companies, and that greater freedom should be given in the raising of loan capital and the issue of redeemable stock.

Such applications would entail parliamentary expenses on many concerns at a time they can ill-afford it, and bring about disturbing local opposition. If it is practicable, it would be better for representations by the gas industry as a whole to be made to the Government to secure the introduction of a General Act giving the relief required, or, failing a General Act, if gas undertakings under like conditions would combine for the promotion of joint Bills.

It is realized generally that it will be impossible for some years after the war is over to raise gas capital on the old pre-war terms. But capital will have to be found to provide modernizing and extensions of plant required, and for gas appliances; and probably where the need is very pressing, powers will be sought to attach a temporary preference to new ordinary stock issued, and to allow same to be offered to existing shareholders and consumers at a discount. Such a course is much to be preferred to starving a concern for capital and placing the whole burden of increased costs on the consumer.

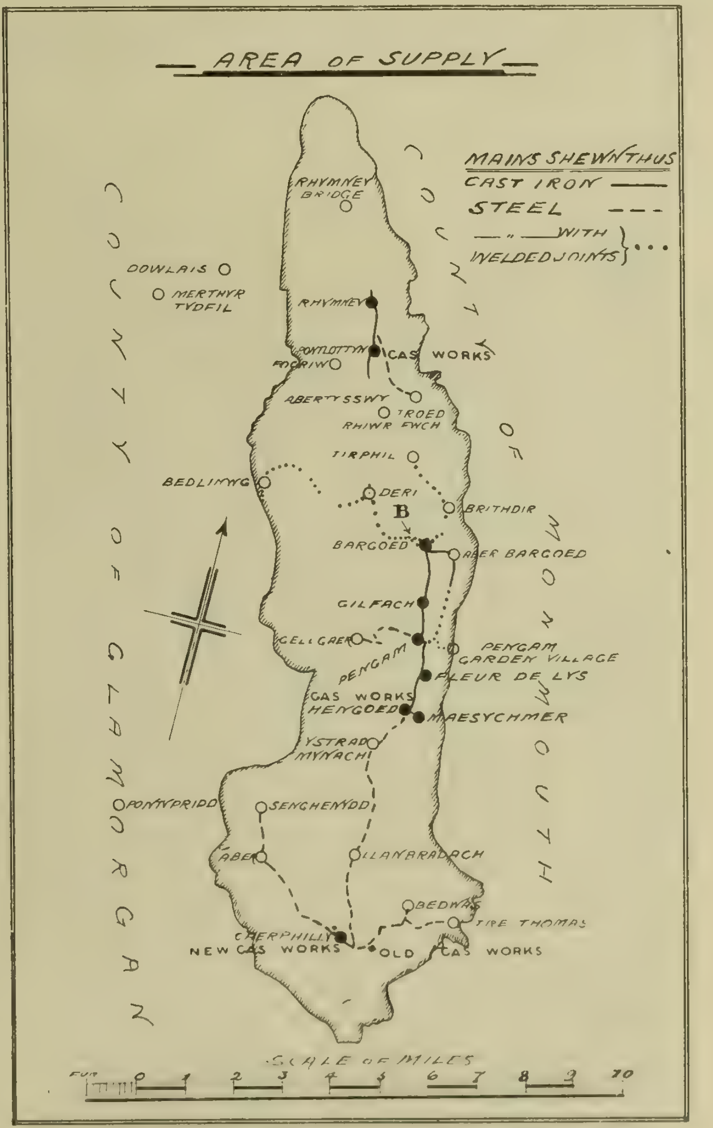
VALUE OF THE SPECIAL PURPOSES SECTION.

It is very much in the interest of a gas undertaking, in these days particularly, that the manager should be a member and attend the meetings of the Special Purposes Section in his district. Many unusual difficulties and matters of urgency in the management of gas undertakings have arisen during the war; and the meetings—affording, as they do, regular interchange of views and experience—are very valuable help indeed.

GAS SUPPLY IN THE RHYMNEY AND ABER VALLEYS.

In meeting at Caerphilly to-day, as the guests of the Rhymney and Aber Company, I am permitted to give some particulars of the system of distribution adopted for the supply of the twenty colliery places now supplied by the Company with gas, and trust they will prove topics for useful discussion by the members.

The area of supply amounts to some 60 square miles, and, as will be seen from the map, includes the Rhymney Valley from Rhymney Bridge to Trethomas, a distance of over 17 miles; the Aber Valley, 4 miles in length, branching off at Caerphilly; the Deri Valley, 5 miles long, branching off at Bargoed; and it also includes the eastern side of the Taff Valley from Bedlinog down to Treharris.



Some eight years ago the places supplied were those shown by a solid black circle on the map; and the object has been to link-up these places with others not then supplied, and centralize the manufacture at one new works at Caerphilly, stopping-down the old works at Caerphilly, Hengoed, and Pontlottyn. A serious objection to such a proposal of linking-up was the very heavy capital outlay for mains, and the increased likelihood of leakage by reason of the greatly increased mileage of mains. The first objection was largely met by the installation of compressors at Caerphilly, Hengoed, and Bargoed, to deliver gas under pressure and enable connecting mains of small diameter to be used.

COMPRESSORS.

The compressor at the Caerphilly new works is of the Bryan Donkin Company's rotary type, water-cooled, to pass 35,000 cubic feet per hour at 115 revolutions per minute against 10 lbs. pressure. It is fitted with a set of forced lubrication arrangement, including three ram pumps, and driven by a horizontal steam-engine with steam at 100 lbs. per square inch. The engine has two fly-wheels, the boss of one of which is formed as a half-coupling, so that a duplicate compressor may be added when desired.

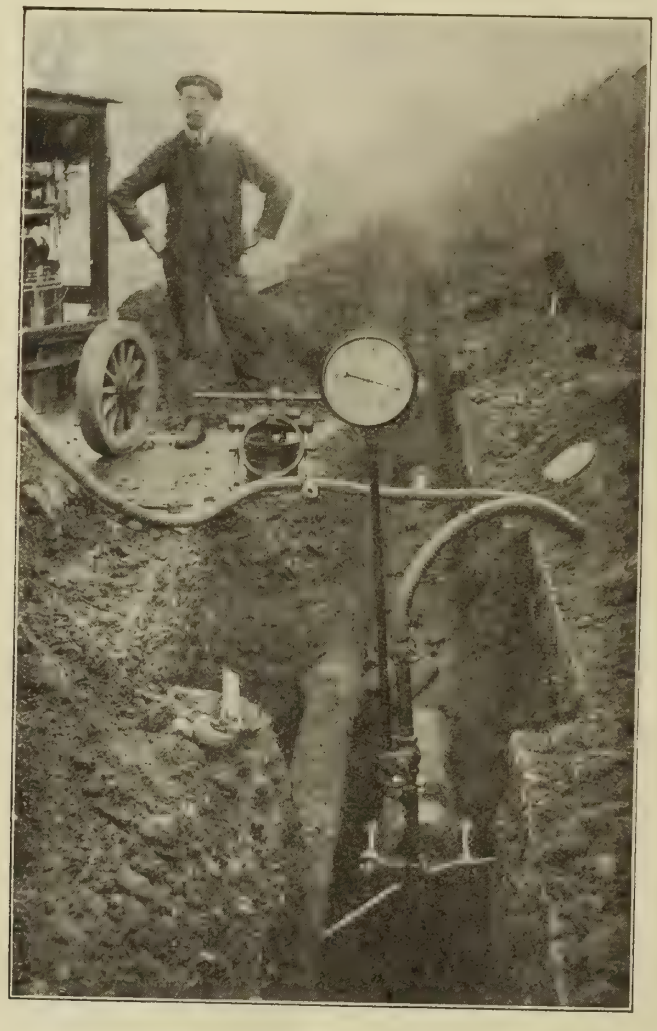
The Hengoed compressors consist of two single-stage rotary compressors, each capable of passing 10,000 cubic feet of gas per hour at 200 revolutions per minute against 3 lbs. per square inch at the outlet, and driven by a horizontal 10 B.H.P. gas-engine fixed between the compressors. The flanged couplings are each provided with loose plates, so that either compressor may be disconnected at any time. This set has now been in daily use for close on five years, and found to be very reliable and to stand the wear and tear excellently.

The Bargoed set is of the same rotary type, each to pass 20,000 cubic feet per hour at 260 revolutions per minute against 3½ lbs. pressure, but driven by separate gas-engines.

STEEL V. CAST-IRON MAINS.

The second objection referred to—that is, the increased likelihood of leakage, owing to the greatly increased mileage of mains—was met by adopting steel mains instead of cast iron, which reduced the number of joints to a minimum. Whatever may be said as to the longer life of cast-iron pipes, the difference in this respect is not to my mind sufficient to counterbalance the advantages of the steel main (coated, wrapped, and recoated), with the rigid or long sleeve joint, for a scattered mining area like the Rhymney and Aber Valleys, either for the distribution of high or low pressure gas. In all cases, the joint was made with lead wool or welded.

In addition to subsidence, there is so much heavy traffic—very often upon roads or lanes with but little foundation—that cast-iron mains with joints every three or four yards, and depending entirely for flexibility on these joints, leak everlastingly, and are frequently fractured. The turned-and-bored joint for cast-iron pipes is, we know, an excellent one under certain conditions; but it is too rigid where there is subsidence or heavy traffic. As an instance of this, a length of about a mile had to be discarded in one part of the valley, owing to repeated fracture.



Testing a Steel Gas-Main with Welded Joints.

The steel main with rigid or long sleeve joints retains the advantages of the turned-and-bored joint, and the pipes do not fracture. In the last six years, over forty miles of coated, wrapped, and recoated steel tubes have been laid with lead wool joints. You will be familiar with the arguments in favour of lead wool; but an experience with a length of cast-iron main with hot lead joints influenced me considerably in its favour.

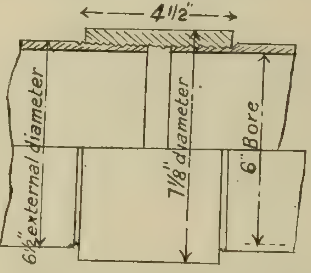
The main in question was a cast-iron one, about four miles in length, with cast-lead joints. Owing to continual leakage, the ground was opened-out in a number of places and the joints recaulked. Ultimately, about three years after the main was laid, it was tested and found to be still losing 346 feet per hour on the whole length. The ground was then opened practically the entire length of the main; and four joints out of every six were found to be leaking. The joints were well filled and neatly caulked on the face—probably before the lead had sufficient time to cool properly; so that some of the shrinkage took place after caulking, and leakage resulted. Most of the joints were leaking near the top. With lead wool, there would have been none of this shrinkage, and the joints would have been knocked-up solid, strand over strand, from the back to the front of the socket in order to put in the specified quantity of lead.

Some long lengths of steel main have now been in use in the district for the last six years, and the ground opened from time to time in very many places. So far, however, I have not seen or heard of any corrosion of the tubes beneath the canvas coating. The time is short; but experience is accumulating which will, I believe, remove the fear in the minds of many as to the life of steel tubes when properly coated and wrapped.

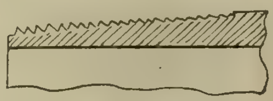
A WEAKNESS IN CURVES.

Although steel tubes and lead wool joints will undoubtedly stand vibration and subsidence better than cast-iron ones, and there is the advantage of having only about one-third the number of joints at which leakage can possibly occur, yet they cannot be absolutely relied on to remain sound. It was found that one cause was the over-curving of the pipes in going round bends in the road. It is certainly very convenient to pull a steel tube round a curve and dispense with special sweeps; but it is liable to be overdone. The tubes, when pulled to the desired sweep, are wedged in position in the trench, and after the ground is filled in, the spring in the tubes tends to press the packing into the sides of the trench and cause the joints on the curve to draw. Then, also, the vibration of heavy traffic still causes joints to leak.

To get over this difficulty when it was proposed to take gas to Bedwas, we considered a proposal by Messrs. Stewarts and Lloyds to lay pipes with a tapered screwed joint, the ferrules having a right and left hand thread as per sketch. This appeared to be an improvement on lead joints, but had to my mind several serious objections—the danger of the threads being damaged when handling the pipes, and the difficulty of entering the pipes into the ferrules and avoiding the crossing of the thread. Then, if a branch connection was required, it would mean cutting and threading the pipe ends in the trench, or else (more probably) using connections with lead joints. These objections seemed so serious that we gave up the idea; but I understand that since then they have been used successfully for high-pressure gas in the Birmingham and Staffordshire district, as also at Tamworth and Preston.



Standard 6-Inch Socket Joint.



Taper Thread.

Later we had offered the steel tube with a rigid or long sleeve welded joint; and after seeing a number of sample joints welded and tested for soundness, both before and after squeezing in a hydraulic press, we decided in favour of their adoption. At first I thought of providing long sleeve lead wool joints with Kimberley collars at intervals, to allow for the expansion and contraction of the main, but came to the conclusion that the variations of temperature to which the main would be subjected, and which is estimated as not exceeding 20° Fahr., would be readily met by the flexibility of the main, and that the joints themselves would have an ample margin of strength to stand the stress.

The first length of steel main with welded rigid joints to be laid in this district was from Bargoed to Deri, some two years ago, and consisted of 1040 yards of 6-inch and 2113 yards of 5-inch. This main has since then been extended over the mountain to Bedlinog, in 4-inch, with welded joints—an added distance of over three miles.

The tubes were welded together outside the trench, in lengths of about 100 yards—being rolled over on supporting trestles to enable the welder to work on the top of the joint all the time. The joints in this way were made more expeditiously and with more certainty of making a good job. Before lifting these long lengths into the trench, they were capped-off at each end and tested to a minimum pressure of 20 lbs. per square inch by means of a hand-wheel pump such as is used in diving operations. Then, after being placed in the trench and welded-up to the length previously laid, the main was tested again, and the position of the joints made in the trench marked, so that they could be readily located if any leakage should occur later.

It was thought that if there was any failure in the jointing these particular joints would be the most likely ones, as welding on the underside of a pipe requires a good deal more skill than when working on top. The cost of the welding on the Bargoed to Deri section (length 3160 yards), inclusive of labour, carbide, oxygen, and use of generator, amounted to £37 8s. 4d., or very little more than for lead wool jointing. The main was laid bottle-tight; and its chances of remaining so appear to me much more certain than in the case of steel tubes with lead wool joints, and infinitely more than in the case of cast-iron mains with cast lead joints.

The gas is supplied from the Bargoed compressors through this main to Deri and Bedlinog at an initial pressure of 3½ lbs. per quare inch; and the two villages are fed through Reynolds dis-ict governors into low-pressure systems of steel mains with lead ool joints. The lower part of Bedlinog is 400 feet below the top reet, and the governors have to be set accordingly; but charts ken at Bedlinog show that the pressure to the consumer is very teady and regular.

From the same compressors at Bargoed a supply in bulk is iven, through about 6000 yards of 6-inch steel tubes with welded oints, to Tirphil and Brithdir. The gas at Tirphil is measured hrough an ordinary station meter and delivered into a holder; ut the supply at Brithdir is taken off the 6-inch high-pressure ain *en route*, through a Parkinson high-pressure meter and a set f Reynolds' governors.

In deciding on the capacity of the compressors at Bargoed, the equirements were estimated as follows:—

Pontlottyn	4,000 cubic feet per hour.
Tirphil and Brithdir . . .	10,000 ,, ,,
Deri	2,000 ,, ,,
Bedlinog	4,000 ,, ,,
	20,000 cubic feet per hour.

The pressure loss with these deliveries was calculated as under; nd it will be seen that an initial pressure of 3½ lbs. per square nch leaves a fair margin.

		Cubic Feet per Hour.	Length.	Main.	Pressure Loss.
			Yards.	Inches.	Lbs.
No. 1 Length	Bargoed to point B on map .	20,000	1040	6	0·42
	B to Tirphil	14,000	4474	6	0·85
	Tirphil to Pontlottyn . . .	4,000	4520	6	0·07
					1·34
No. 2 Length	B to Deri	6,000	2113	5	0·17
	Deri to Bedlinog	4,000	5300	3	2·50
					2·67

These deliveries at ordinary low pressures would have required at least a 14-inch main on the No. 1 length and a 10-inch main on the No. 2. The pressure at the point B is 3·08 lbs., and sufficient to deliver gas through both lengths of main from B to Pontlottyn and from B to Bedlinog. The length from Deri to Bedlinog was finally laid in 4-inch instead of 3-inch, with a view to possible developments at Bedlinog.

It will be noticed on the upper part of the map that the length of main from Tirphil to Pontlottyn is not linked-up yet. Between these two places there is a portion of the road, about ¼ mile in length, which is slipping and settling towards the river, and has for some years been an endless source of trouble and expense in connection with the trunk water-main which passes along it. This main—part 14-inch, part 12-inch—has been broken or the joints drawn right out, time after time, owing to the movement of the ground. I have a vivid recollection of one February when a length of 50 to 60 feet broke away six times in three weeks, and we were engaged night and day on its repair practically the whole of this time.

About three years ago, this main was relaid in the worst place with 12-inch steel tubes with long sleeve lead wool joints—the pipes telescoping 14 inches. Since then there has been no further fracture of the main; and although the joints still draw, the process is more gradual, and the need for opening-out much less frequent. The Company have not decided so far to lay a gas-main along this piece of road; but if one is to be laid, it would almost seem that the only reliable way would be to lay a steel main with welded joints on the surface at the side of the road, and level it from time to time.

I will not take up your time further with details as to the arrangements for supply throughout the whole district. In each case, the compressors deliver either into a gasholder or through a governor into a low-pressure system of mains. The point is, however, that only by high-pressure distribution and the use of steel mains is it practicable to supply so many comparatively small outlying places. To use low pressure, the capital outlay in mains would be prohibitive, and to use cast-iron mains with lead joints would undoubtedly result, with such a long mileage of mains, in very excessive leakage. By the methods adopted, the output has been rapidly increased in the last eight years from 34 millions to 154 millions, accompanied by reductions in price, capital per million, and increases in dividends.

The problem of distribution in a district like this is not by any means an easy one, either in the case of gas or water; and as the members are engaged for the most part in similar areas, or probably worse as regards subsidence, I thought the subject would be of interest and draw useful discussion.

DISCUSSION.

Mr. **Thomas Canning** (Newport) said that he was perfectly sure there were a great many present who appreciated the address quite as much as he himself did, and who, at the same time, were certainly more capable of discussing it. A lead was, however, required from somebody; and it was this alone that prompted him to stand up the first in order to make a few observations. Before proceeding further, he wished to congratulate the President most sincerely upon having undoubtedly produced an address which for value and perfect clearness of expression he had seldom seen equalled in any of the addresses delivered, not only before their Institution, but before others. He was pleased to hear the reference to the Coal Prices (Limitation) Act, but could have wished very much that the President had given them the benefit of his advice to a greater extent upon this point. Perhaps, however, it was, on the whole, as well that this should not be done, and that they should not say too much about this matter at the present moment. It was going to become a very important question, and probably would lead to some considerable difference of opinion between the owners of gas undertakings and the owners of collieries. This being the case, it might be best for them, for the time being, to withhold any discussion upon the point. One thing seemed to him to be quite certain—and he believed the majority would be with him in this—that the maximum limit which had been fixed by Parliament in the Act was unquestionably most generous towards the coalowners. ["Hear, hear."] They had no right whatever to be standing against it; and he was perfectly sure that, if the owners of gas undertakings would buckle-up to the matter, and stand with a firm front, they would be able to prevent, to a considerable extent at least, any price being imposed upon them beyond that which, as he had said, had been so generously given by Parliament. There was nothing more important or more instructive in the whole of the address than the very lucid description which had been given of the system employed for the distribution of gas in this great district—for it was a very large district indeed to deal with. One point he agreed most strongly with was that it would be an economical impossibility to supply gas over this area without the adoption of high pressure; and with high pressure they could only have introduced steel mains. The life of these mains he knew was a much disputed matter. Experience had, of course, not yet been very extended on the point of durability; but he happened to have had one of these mains laid for the last fourteen years or so. At the end of about twelve years, he examined the main, to see the condition it was in. It was covered, coated, and re-coated, exactly as had been described in the address. It was also in a damp position—in fact, though not exactly flooded, the ground was from time to time thoroughly saturated with water. What he found was that the main was in quite as good a condition as when laid. The only change observable in it was that the coating, covering, and all the rest, had now become so much part and parcel of the main that it was very difficult to tell that it had ever been coated at all. They had completely amalgamated. He then thought it was advisable to see what was the condition of the steel beneath the coating; and on opening it at a particular point, he found it was in a state of perfect preservation. Therefore he had no fear whatever about the durability of these pipes. When laying them, they took very good care to provide themselves with a supply of coating, so that they could repair any abrasions, if these should happen to be caused in the transit of the pipes from the foundry to the works. It was absolutely necessary that these abrasions should be carefully noted, and when found they must be coated and re-coated. And the same with regard to joints. Those made with lead wool were certainly excellent. Presently he might say a word with reference to a better system, but lead wool joints were superior, in his opinion, to those made with hot lead, provided always—and it was a big proviso—the jointing was done properly. As the result of great experience with this system of jointing, he could state that it required something like three times the amount of labour in the caulking that the hot lead joint needed. There was no doubt whatever about this; and unless the labour was expended on them, the lead wool joints would not be as good as the others. Therefore they must take care that the joints were well and substantially made. Welding was undoubtedly the coming system; and he had already resolved that the next long length of main that it might become necessary for his Company to lay in steel, should have welded joints. He thought in the long run it would be found that they would cause great lessening of the risk of gas leakage. He was very pleased to see from the address that the Rhymney Company had succeeded in supplying the district of Bedlinog with gas. Anybody who visited that place, would see how difficult it was to furnish it with gas. He happened to be aware of this, because the District Council in whose area Bedlinog was situated asked for his views on the question of whether they should purchase gas or make it independently themselves. He thought he had given them the best advice—more especially when he understood that gas was already being satisfactorily supplied.

Mr. **H. D. Madden** (Cardiff) said he would like to associate himself with the congratulations of Mr. Canning to the President on his very clear address. The points dealt with would be very useful for reference, not only to members of the Institution, but also to others. The experience of steel mains in the area of supply shown on the chart, as stated by Mr. Branson, would be of great value to them. When the President first came to Caerphilly, he had a difficult task to perform, as he indicated very lightly in his address. It appeared that the only solution of the question of supplying the valleys was the employment of steel mains, and the scheme of distribution which had been outlined for linking-up the different points. Caerphilly and the surrounding district were to be congratulated on having had Mr. Branson for Engineer at that time, when so much reconstruction work was necessary, and also when extensions were taking place very rapidly. In regard to steel mains, he would like to add a word to what Mr. Canning had just said. If lead wool was used, it was the care taken in hitting-up the joints that made a tight joint. He had not himself had experience of welded joints, and he would like to ask what was the effect of temperature in the mains underground. He did not mean with gas at ordinary pressure, but when coming from the compressors at a pressure of from 3 to 10 lbs. per square inch. When there was a fluctuating consumption, the temperatures varied considerably, unless some means were taken whereby the gas could be bye-passed. What he meant was that working under compression would raise the temperature inversely as the flow of gas came from the compressors. At night time, there was a constant cool stream of gas passing through the mains; but as the lights were shut off, and the consumption went down to (say) one-twentieth of the maximum, the compressors would be churning. Without some bye-pass arrangements, therefore, most people had found that the temperature was unduly raised, and expansion took place in the steel mains in the vicinity of the compressing station.

The President: There are automatic bye-passes to each set of compressors, so that when the pressure rises to a certain point the bye-pass comes into action, and the speed of the engines is at the same time reduced. This does away with the temperature trouble.

Mr. Madden said he had mentioned this point because he thought temperature did play a very important part in the expansion and contraction of steel mains, unless properly provided for. Experience had not been long enough for them to know what the life of these mains was; but in cases where they had been down only a few years, and had been opened up, he had examined them and found the laps in quite good condition. With a new holder now being erected, they had steel inlets and outlets put in. Of course, steel had the same advantages there as on the district. With cast iron, there was liability to fracture, which was entirely done away with by using steel; but the same precautions against corrosion had to be taken in that case.

Mr. R. A. Browning (Neath) remarked that there was just one thing arising out of the address which had struck him. In the case of gas undertakings experiencing difficulty from small mains and consequent insufficient supply, for the manager to go and tear up his streets or roads for the purpose of laying larger mains meant great trouble, and one that should be avoided as far as possible. Therefore, he thought that the references to pressure-raisers came in very opportunely. Instead of replacing their mains—especially at this time, with everything so dear—when they found there was a difficulty in getting adequate pressure at the extreme ends of their district, they should have some simple form of pressure-raiser that would overcome the trouble, and would probably only be required during certain hours.

Mr. G. R. G. Clarry (Swansea) said that the remarks in the address on the subject of mains were of particular interest to him. He had not had very much experience with steel mains; but he had always thought one of the principal difficulties in deciding as to steel was the question of tapping the main. The President did not make any mention of this; and he would like to know whether there really was any difficulty arising in connection with it. Owing to the not very thick pipes, the threads might soon pull out; and he understood the plan of fitting a back-nut was not entirely successful.

Mr. J. E. Kenshole (Merthyr) said he had in mind the marked effect on the output of gas that had resulted from the restriction of public lighting. They knew that notices had been sent out to the local authorities asking them to reduce expenditure as much as possible; but he did not think it was quite the thing to do it at the expense of the public lighting—especially when the High Explosives Committee were calling for all the toluol they could get. If they were going to restrict the output of gas, the output of high explosives must be restricted also; and he thought this was rather the wrong way of going to work. He quite agreed that it might be necessary to do it on the East Coast, and in places where they could be bombarded or which Zeppelins could visit; but in the Midlands and on the West Coast, it did not seem to be called for. With regard to the financial questions that were likely to arise, it was certainly hard that gas undertakings should have to suffer—more particularly those working under the sliding-scale. A maximum dividend company was not affected to the same extent. There were some companies to his own knowledge who had got a low standard price, which in normal times was only just sufficient to enable them to earn and pay their standard dividend of 5 per cent.; and he did not think anyone would say that 5 per cent. was an exorbitant dividend in these days. But in consequence of the large increases in the price of coal (which they were quite unable to control), there were a number who had had to raise the price of gas; and as a result their dividends had been reduced. Something should be done for these companies; and he believed if proper representations were made to Parliament the probability was that they would be allowed either to increase their standard price temporarily or to increase the price of gas without reducing their dividend below 5 per cent. They were all aware that there were a large number of people dependent to a great extent on their investments in gas companies, which had always borne a high character as steady dividend-payers. As he had said, 5 per cent. was not excessive; but when this was reduced to 4 per cent., and in some instances even lower, and the tax deducted, in the case of those liable to income-tax, it was a very serious loss to investors. Therefore, something should certainly be done to bring the position of these companies before Parliament, with a view to the provision of a remedy. The question of raising capital in the future was no doubt going to be a very difficult one; and those companies who might have to resort to this step in the next few years, would, he was afraid, have to raise it at a discount. He did not see any possibility of them being able to place 5 per cent. investments at par, or anything near it.

Mr. W. C. Jackson (Neath) expressed the opinion that the question of steel mains was one which certainly all the younger engineers were bound to go very deeply into in their time. It was gratifying to them to have heard the remarks of Mr. Canning, particularly regarding experience with steel mains in his district. He took it that in all cases it was essential that the mains should be coated, covered, and re-coated. It would not be sufficient to put steel mains in with simply a tar or bitumen coating without the wrapping. Mr. Clarry had also raised a question about the services, which was a matter that some of them would be glad to have advice upon. There were a number of service plants on the market; and they heard so much of the merits or demerits of this, that, or the other, that they would be glad to have some clear indication as to what was really considered to be the best method available. With reference to the nature of the soil and its influence, probably in the work of excavating over this large district the President had come across very varying soils; and, if so, it would be interesting to know whether he had noticed any difference in the effect of soils on the piping. Then, as to the depth at which the mains had been laid throughout the district. Were they tied to any particular depth, or by the use of steel mains had they been able to have less covering than had been the case with cast-iron ones?

Mr. A. J. Ward (Cardiff) remarked that, in view of the fact that they had laid steel mains at the Queen Alexandra Dock seven years ago, it might be interesting to hear what his experience had been. At that time, they put down about 3000 yards of 6-inch and 4-inch mains around the docks, in ground of varying character—some sandy soil, some clay, and some ashes with a good deal of alkali matter in it. On several occasions they had had to open the ground for the purpose of inserting new services, and so on; and the condition of the main had come under his own personal notice. What he had found was that the mains were in perfect condition—as good as, and perhaps better than, they were the day they were laid. There seemed to be a difference in the composition of the covering material after being exposed to the action of the earth in which the pipes were laid. The covering when laid in the first place was comparatively soft; but he found it was now exceedingly hard. It seemed as though a certain amount of silicate from the sand had become incorporated in the pitchy surface of the coating; and it was very nearly as hard as a stone. In fact, as Mr. Canning had mentioned, there appeared to have been a sort of chemical affinity taking place between the coating of the pipe and the steel. The only danger one had to guard against was the possibility of other men opening-up the ground and breaking into the coating with picks. It had to be seen to that places where abrasions occurred were quickly covered. With regard to connections, those he had used were of his own design. They were cast-iron double clips turned to the true surface of the main, and drilled and tapped to suit different sizes of service-pipes. He allowed the bend or the service-pipe to always go through the clip, so as to form a spigot which entered the hole in the main, and prevented any alteration of the position of the clip to bring it athwart the hole. He then put in lead washers and screwed down with two $\frac{5}{8}$-inch bolts. This he found made a remarkably good job. Several of the connections had been opened up, and they were perfectly tight. The soft lead washer round the spigot was squeezed right down on the main. An important point was that the bend should be allowed to go through the clip and into the main. He quite agreed that a lead wool or a welded joint would be superior to run lead joints for mains; and in the event of his laying any further mains of this description, he would certainly go for the welded joint.

The President remarked that, as the time was getting on, he thought they must close the present discussion. He was obliged to the various speakers for the generous terms in which they had referred to his address. Any commendation coming from Mr. Canning, for example, with his long experience, was exceedingly gratifying. In his opening remarks, Mr. Canning—whose views on gas matters they always appreciated—agreed that it might be wise not to say too much about the Coal Prices (Limitation) Act. In the North of England, they were still a little vague about the working of the Act; and it was a question that would be better dealt with by the Special Purposes Section than in general meeting. At any rate, whatever was done should be done unitedly, because the opposite camp were strongly united. With reference to Mr. Canning's emphasis upon the need for care in laying steel mains with lead wool, this was a very important matter indeed. There were a considerable number of points about laying steel mains which should be carefully kept in mind—points that could only be learnt by experience. Anyone attempting to lay steel mains must use every possible care. They should never be laid without being coated, wrapped, and re-coated; and any damaged spots, such as had been referred to in the discussion, should be properly attended to. In this district they had always used the Woodall and Parkinson expanding nipple and saddle, and had found it an excellent arrangement. The nipples, however, needed careful examining and gauging, so as to make sure they would expand when fitted in the main. When the saddle was fixed, the whole thing was as firm as a rock. One simply could not knock it ut of the main, if properly fixed. They had used some thousands f these; and, as he had said, they found them very satisfactory. With regard to the coal question, he did not know what the experience of the members might be as to coke licences; but in his part they had had a pretty broad intimation that the Coal Exports Committee intended to refuse licences for coke to a very considerable extent, and so ensure a large quantity of coke being kept in stock, in order to make up for any shortage of coal that might come about. This was rather hampering them; and he expected in that part of the world they were having the same difficulty. Indirect hints were being given, also, that if the price of coke locally was raised, such places were likely to be black-listed, so far as licences were concerned. Mr. Kenshole had referred to ighting agreements. What he (the President) had in mind was the restriction of lighting as the result of military orders, which corporations and councils had no choice but to carry out. But, even then, he thought they were not entitled to any further allowance than the amount that was saved by the gas company not having to manufacture the gas. The same thing applied to local authorities' ighting contracts. Any allowance made should only be the actual saving to the gas company by not supplying; and the profit that was estimated for in these agreements should still be received by the company. Interest on capital had to be met; and the plant was there, and had to be fully maintained, whether or not the agreements were carried out. With reference to the soil in which the steel mains had been laid, it had not, so far as he could remember, varied very greatly in that district, except, perhaps, when going over mountains. In one place, portions of ground were met with which were very peaty. He did not himself fear that the mains would corrode with the coating on them. This was the only part of the district, however, where there might be risk from the nature of the soil. The depth at which the mains were laid had always been with a minimum of 2 feet of cover. Some time ago, steel-tube advocates talked a good deal about 18 inches of cover; but he thought this was light for districts like Wales, where the roads in many cases were not strong, and there was much heavy motor traffic. Steel mains might bear the weight better than cast iron; but there was no need to put them near the surface for this reason. Any possible economy in such a direction was hardly worth taking advantage of. He had mentioned the question of men's badges. They had started to give badges at the works in Hartlepool. Private badges previously issued had been called in; and the new ones were being handed out in a very strict fashion. They were given to those engaged practically in carbonizing and on the carburetted water-gas plant; and they had refused them to the gas-fitting and inspecting departments. He was still trying to obtain badges for a certain number of these latter men; but so far without success.

On the proposition of Mr. Octavius Thomas, seconded by Mr. Kenshole, a hearty vote of thanks was passed to the President for his address.

Report of the Special Purposes Section.

Mr. T. H. Hazell (Newport), in moving the adoption of the report and statement of accounts of the Special Purposes Section for the past year, said the report showed the advantage of possessing such a section. Some of them much appreciated the information that had been received and passed from one member to another—in connection with the disposal of coke, for instance. There was a time within recent months when coke was a drug on the market; but, thanks to the information that had passed from mouth to mouth, some of them were able to find markets, and consequently to get better prices for their coke, owing to the existence of the Special Purposes Section. He, for one, was much disappointed with the result of the discussion that took place in connection with the Workmen's Compensation insurance. It was hoped that, by combining these risks in one company or one agency, it would have been possible to get to bed-rock rates for premiums. But, unfortunately, it seemed that everybody was on the make for himself. He was very glad reference had been made to the Coal Prices (Limitation) Act, though he agreed that it was as well not to say too much about it at the present moment. Those, however, who were particularly interested in the Act might be warned that gas undertakings did not read it in the same light as the colliery people did. The gas people looked upon it as a Limitation of Price Act; whereas, so far as he could find out, the collieries were disposed to regard it as a Coal Price Minimum Act. That was to say, they were inclined to base their negotiations upon 4s. as the minimum advance which they felt prepared to make in the price of coal under contracts that were affected by the Act. Those who were concerned with this business would have to look very carefully into matters. The balance-sheet of the section showed up satisfactorily; there being an increase in the amount in hand. He trusted attention would be given to the last paragraph of the report—"The Committee consider the work done by the section during the year has fully justified its existence; and it is hoped that during the coming year more members will join, so as to strengthen the section." He would like to say how pleased they all were to see the President among them once again that day, even though it was only for a short time. No doubt Mr. Branson was as glad to come to Caerphilly as they were to see him there.

Mr. Browning seconded the motion; and it was agreed to.

Representative on the Institution Council.

The President said it was unanimously recommended by the Council that Mr. H. D. Madden, the ex-President, as was the usual custom with them, should be appointed as their representative on the Council of the Institution of Gas Engineers for the year commencing in June, 1916. He begged to propose this.

Mr. R. G. Clarry seconded the resolution, which was carried.

The "C" Process.

The President remarked that they had been expecting to have Mr. John Bond, of Southport, with them, to speak on the "C" process; but unfortunately he was unable to come, owing to his being obliged to attend a Council meeting in London. The short time, however, that remained to them would be well filled by Mr. Speyer's paper on home sales of sulphate; and he would now call upon that gentleman.

HOME SALES OF SULPHATE OF AMMONIA.

Mr. F. C. O. Speyer (London) then read his paper on this subject, which was on the lines of that which he read before the North British Association at their Edinburgh meeting a few weeks ago, and which was reproduced in the "Journal" for Sept. 3, p. 512. At its conclusion,

The President said it seemed to be the wish of the Association to get gas-works to fix prices, and to encourage merchants to stock sulphate. Whether, however, the 10s. per ton proposed would be sufficient to induce corn and manure merchants to put themselves about, was a matter of doubt to him. In his own case, they supplied a number of local farmers, within a radius of (say) 8 miles of the town; and they had taken the same amount for many years now. The consumption did not seem to grow; and he doubted whether 10s. a ton was going to induce merchants to bring them more customers. Mr. Speyer said they carried out this system in Scotland; but he did not tell them with what success. That was to say, what percentage of the make in Scotland they sold at home. This would be a useful guide. They were all, he thought, convinced that the time had come when they should combine for the sale of sulphate of ammonia. Improved methods on the Continent, and the fact of this country having been supplanted as the leading maker, might be expected to have their effect on prices.

Mr. Thomas Canning (Newport) said the paper was one which invited questions. He noticed that the author, at the very start, remarked that the broad facts of the situation were known to all, and there was fortunately no dispute about them. Then he went on to say they were all agreed that sales of sulphate of ammonia in the British Isles were not nearly as large as they could, and should, be. No doubt, they would all assent to this. It was a short, but very pregnant statement, and one which it was unfortunate to have to make. The best nitrogenous manure, he believed, was the one commonly called sulphate of ammonia, and produced so largely in this country; but when Mr. Speyer went on to say they all knew that nitrate of soda, cyanamide, and Norwegian nitrate of lime were rapidly increasing, he would like to ask a question or two on the point. He did not know how Mr. Speyer meant to show them that nitrate of soda had increased. Did he mean that new deposits had been discovered; or, if he referred to the manufacture of nitrate of soda, was anyone attempting to carry out a process of this sort, which was the only other way of increasing the supply. It would be remembered that Sir William Crookes some years ago—he thought it was when President of the British Association—drew attention to the matter by means of panic statements about the decrease of nitrates, and induced Lord Rayleigh to make experiments with a view to finding electric processes by which free nitrogen and oxygen could be combined, so that it would be easy to proceed with the production of the acids. Then Sir William Crookes stated that, if electric current could be made for one-seventeenth of a penny per Board of Trade unit, nitrate of soda could be manufactured at £5 per ton. An unfortunate tragedy came out of this. Very many patents were started at the time; and among them was a very notable one worked by Messrs. Bradley and Lovejoy, who had the water power of Niagara for running it. They were no mean men at the work. He did not know exactly at what price the electric current was produced; but, at all events, he knew the potential was as high as 10,000 volts. This had gone out of existence; it ran for fifteen months. Therefore, he wanted to know where the author got his increased production of nitrate of soda from. Now, in regard to cyanamide. He himself took some pains a short time back to find out where this was produced; and he discovered it was made chiefly in an establishment near Rome, just in the hills above the city, because there was the advantage to be had of water power there, and also because it stood side by side with a calcium carbide manufactory. Though these establishments were in the names of Italians, it had been found since the war broke out that they were being run by Germans. The amount of cyanamide produced was not great. Other establishments had since been put up—one, he thought, in Savoy, another in America, and there was an establishment in Norway. He would like to know what their output was, and also whether the author had inquired of any agriculturist or any authority on plant nutrition as to what was the opinion held regarding the value of cyanamide as a manure. All he (the speaker) could say, treating it from the scientific side, was that their proposal was that an electric horse power would fix theoretically 772 kilogrammes of nitrogen. Their practice to-day was 300 to 330 kilogrammes—less than half their promise. He knew they also promised to turn out 35 per cent. nitrogen. In sulphate of ammonia, they reached 20 to 21 per cent., and probably more; but the practice of these other people was below that, for they were only sending out 20 per cent. Then there was what was referred to in the paper as the nitrate of lime process. He happened also to know the results of working this. There was an establishment in Norway now using the patents of a very celebrated man, Berkeland, who had calculated that by his process he would give—35 per cent. or 20 per cent.? No; 13 per cent. Whether or not this was being done, he was unable to say; but it was stated that the stuff could be sold at £8 per ton. If they took the two values, nitrogen for nitrogen, this would represent nitrate of soda at about £10 a ton. Wonderful things were said in papers, and even at scientific meetings; and therefore it became necessary sometimes to inquire into these statements, and see whether they were really quite as wonderful as they seemed. This was what he was now endeavouring to do. In 1912, the total production at this factory in Norway was 20,000 tons per annum; and the plans for its extension showed that it was intended to bring it up to 36,000 tons a year. In view of what he had said, he would like to know from the author what evidence he had of the increase in production hinted at in the paper. To go back to the German production. The synthetic sulphate of ammonia which Germany was producing had only taken its present form, and its present great increase, since the outbreak of the war—for a very obvious reason, which he need not dwell upon. As to what the actual results were, he was quite unable to say; but he would like to know from whom Mr. Speyer had obtained the test of 25 per cent. He (Mr. Canning) had read the German accounts of the process, and knew what they had claimed for it; but he wanted to know whether there was any reliable test. With reference to the question of their approaching the merchants, this was all very well. The time at the disposal of the meeting was too short to go into the whole of the matter; but he would like to know whether the merchant was supposed to push the sulphate of ammonia with a farmer, whether he knew how to use it or not. It was a great misfortune for the whole industry that, having the best nitrogenous manure in the world, the county councils—who talked about education and spent money so largely upon it, and who had advising them in their position of directors of agricultural instruction, some of the best agriculturists to be found in the whole kingdom—had taken no steps to teach farmers the right use of sulphate of ammonia in agriculture. He would like to know how it was that, this sulphate of ammonia being a British article, steps had not been taken before the war to teach the farmers of this country how to use it. They were often employing it most ignorantly to-day. Many of them would use the sulphate without troubling as to whether or not the soil contained the ingredients necessary to make it effective; and the result could only be failure. In other cases they could use it until they had exhausted the lime, and would not replace it, not knowing the elementary principle involved. Therefore they wanted the farmer instructed, before the merchant was going to drop sulphate of ammonia down at the door of a man who probably did not understand it. This question was of the greatest importance. He was quite at one with the author that there was nothing needed more in this country than the promotion of home consumption ["Hear, hear."]; but they ought surely to do it thoroughly well. He was rather curious, too, with respect to this question of the 25 per cent. test, as against $24\frac{3}{4}$ and 24 per cent. He did not at all object to using the 25 per cent.; but he would like to know why a consumer, if he was now getting $24\frac{3}{4}$ per cent., should be so anxious to get the other $\frac{1}{4}$ per cent., which only represented $\frac{1}{5}$ per cent. in nitrogen. This was a point which had aroused his curiosity, but not his opposition. It must be a hungry bacterium indeed that required this small modicum of nitrogen that seemed to do so much and to make such a difference. He hoped Mr. Speyer would not consider that he was criticizing either him or his paper unfavourably. He was with him in the view he desired to bring forward to-day; but he wanted to let the people generally know that they ought to be, through the public councils of the country, supporting their own industries, and that one of the most important of these industries was in connection with the subject they were now discussing. It was a matter which involved one of the greatest advantages to the nation at large, because they would be increasing the nation's food—a vital question at present, and one which would become of still greater importance as time went on. [Applause.]

Mr. W. C. Jackson (Neath), referring to the author's remark about sulphate of ammonia in Scotland, said he himself came of a farming stock; and his own home, the county of Fife, was, he thought, the one in this country which went in mostly for intensive cultivation. At each of the auction markets in the two centres, the corn merchants canvassed farmers regularly for sales of sulphate; and knowing as he did a number of gas-works in that part, he thought he could say they got rid of practically the whole of their output directly at these auction markets. In a place like Fife, with so much intensive cultivation practised, they got every bit from the land; and there was not a more contented set of farmers in the kingdom than there.

Mr. W. B. Mimmack (Pembroke) thought they were to be congratulated upon the fact that the paper had brought forth Mr. Canning's remarks. That gentleman had hit on the real difficulty when he said that lack of education stood in the way of the use of sulphate of ammonia to the extent that it ought to be employed. The knowledge of its capabilities was far greater among foreign nations—nations as far distant as Japan—than among British farmers, so many of whom were ignorant of its uses and showed inability to properly apply it. Mr. Canning said it was very important that the public institutions of the country should take this matter up, and include it in their educational syllabuses, so as to instruct the farmers and the people generally in the methods of application. But why had not the producers done this? Surely, it was up-against the producers to make this provision, and to see that the farmers were properly instructed in the use of the sulphate. He remembered talking a few years ago to a gas manager who had gone through a course as an agricultural chemist at one of the colleges. He manufactured a small quantity of sulphate—he believed about 40 tons a year—and he made up his mind that he would get rid of it entirely locally. He had a man on the works who understood how to apply sulphate; and whenever he sold the material to a local farmer, he sent this man out to apply it under the best conditions. Before very long, he was selling 150 tons a year, in his immediate neighbourhood, and had to go out and buy 110 tons to meet the demand.

Mr. Speyer, on rising to reply, thanked the members heartily for the kind reception accorded to his paper, and also for the extremely instructive criticism passed upon it. With regard to the lack of education of the British farmer, and the question asked as to why producers did not do anything to overcome this, the answer was that they had. Ever since the Sulphate of Ammonia Committee was formed, producers had been contributing a larger sum every year towards educating the farmer. This had been the work of the Sulphate of Ammonia Committee, which was now amalgamated with the Sulphate of Ammonia Association. They fully realized the importance of this, and intended to continue scientific propaganda on a larger scale and with increased energy. But they did feel that the commercial side of the question was not receiving sufficient attention, and were convinced that one of the reasons why more sulphate was not sold in this country was that producers would not take the trouble to increase their sales. The interesting increase in sales effected at a small producer's works of which they had just heard was really an illustration of what he meant. That was to say, the small producer had plenty of time to go about in a good agricultural district and induce farmers to buy sulphate; but large producers had not time, and could not be bothered to do it. The President had raised a point about 10s. a ton not being sufficient inducement for the merchants. When the Association suggested this figure, they made inquiries among large factors, and came to the conclusion that, at any rate for the present, this would be an inducement to them to undertake the business. As to the success which had been achieved in Scotland owing to selling through merchants, he had no precise figures; but inquiries had led them to suppose—and he was glad to have found support for the supposition at the meeting—that, owing to this encouraging of the merchants in Scotland, more sulphate was applied, comparatively speaking, than was the case in England. Mr. Canning had raised a very interesting question with regard to nitrate of soda. The reason of the increase in production of this commodity was to be found in the improved methods of manufacture. Owing to these improved methods, grounds which it was not possible to work in previous years were being dealt with, and he might say that there was a proposal now before the Nitrate of Soda Committee by which they hoped to increase the annual production of nitrate from 2,700,000 tons to some 5,000,000 tons. Whether this would be accomplished in actual practice, he did not know. What he had said here applied entirely to Chili. As regarded cyanamide, important factories in Dalmatia produced this; and great developments had taken place in Germany since the war. As to the suitability of cyanamide and nitrate of lime as a manure, experiments were being conducted; and he had lately spoken to several agricultural chemists, who seemed to think that on certain soils quite as good results could be achieved as with sulphate of ammonia. Mr. Canning further asked whether he had verified the test of 25 per cent. with synthetically produced sulphate. Before the war, such sulphate of ammonia was bought and sold in this country; and he had tests in his office which were made by recognized English chemists, and also independently by English manufacturers, to whom he sent sealed samples, and they absolutely confirmed that the salt tested 25 per cent. As to the question of the preference for 25 per cent. sulphate of ammonia, as against $24\frac{3}{4}$ per cent., the fact was that this German production was guaranteed 25 per cent., and it would therefore be preferred to $24\frac{3}{4}$ per cent. It was purely a question of supplying the demand.

The President proposed a very hearty vote of thanks to Mr. Speyer for coming down and reading his paper.

This was seconded by Mr. Kenshole, supported by Mr. Canning, and carried with applause.

Toluol.

The President then asked Mr. J. H. Canning, who, he said, had done so much in connection with toluol recovery, if he would say a few words in the regretted absence of Mr. John Bond.

Mr. J. H. Canning (Newport), responding to the invitation, informally gave the members some very interesting particulars regarding the subject.

Place of Next Meeting.

It was resolved that the question of the place for holding the next meeting should be left in the hands of the Council to decide.

Thanks to the Company.

Mr. Madden, proposing a vote of thanks to the Chairman and Directors of the Rhymney and Aber Valleys Gas and Water Company, for the use of their offices, in which to hold the meeting, and for the hospitality they were about to enjoy, said he had one regret in doing so—and this was that they had not with them Colonel Fisher. He knew that when this meeting was arranged some time back, Colonel Fisher was in high glee, and hoped to meet the members on the occasion. This, however, was not to be, unfortunately.

Mr. F. C. White (Blaenavon) seconded the vote, which was heartily accorded.

Luncheon.

At the close of the business meeting the members adjourned to the Boar's Head Hotel, where they were the guests at luncheon of the Chairman and Directors of the Rhymney Company. The chair was occupied by Mr. J. P. Jones (the General Manager and Secretary), who expressed regret that neither the Chairman nor any of the Directors could be present to welcome the visitors.

Mr. Hazell (after the Loyal Toast had been honoured) proposed the "Wales and Monmouthshire Institution," coupled with the name of Mr. Branson. The Institution, he understood, was now about ten years old. They would agree that it was a very sturdy infant, and had accomplished great things. It had united together in one body all, or nearly all, of those engaged in South Wales and Monmouthshire in the work of producing the principal illuminant of the times. The Institution had had the advantage of being led by capable men. So far as Mr. Branson was concerned, there was only one feeling—that, however well the office of President had been filled in the past, he had not dimmed the lustre of the office, but had if anything added to the importance of the position. The Institution had done a great deal for the different undertakings connected with it, and it had done a great deal for the consumer. It was an undoubted advantage that the members should combine together to impart their knowledge and experience one to another. Benefit was bound to result on all sides. To Mr. Branson they might offer again, as they offered once before, their congratulations that he had come safely through a very critical and a very exciting time. Considering the effects of the shelling of Hartlepool, he could at any rate expect that, having gained so little by their great enterprise, the "valorous" Germans were not very likely to pay the place another visit.

Mr. Branson, in response, said it was gratifying to find, even in these times, when managers were naturally reluctant to leave home, they could gather together in such strength as they had that day in so out-of-the-way a place as Caerphilly. The manager of even the smallest undertaking possessed experience and knowledge peculiar to himself; and if he could be induced to pass this on, he was benefiting the industry. There never was a time when it was more necessary than now that they should be united. The Commercial Section in the North of England had been a perfect god-send in keeping them through this strenuous period. Things were almost straight again at Hartlepool. It had cost them £4000 to repair the largest holder, and the work was nearing completion. There was still another to make permanent repairs to. The Government had paid them £7000 odd towards the damage; but this, of course, would not cover the cost. He hoped to remain a member of the Institution as long as they would allow him to do so. He looked back with great pleasure, and a tinge of regret at having left the district, upon the very happy time he spent in South Wales.

Mr. Thomas Canning proposed health and prosperity to the Chairman and Directors of the Rhymney and Aber Valleys Company, their Manager, and their Engineer. Mr. Jones, he said, was a very able, painstaking, hard working, and conscientious man in every respect; and he was sure that in his hands the undertaking would continue to progress as it had done under the care of his predecessor. They had been received at Caerphilly in a manner which had given satisfaction to all.

Mr. Jones, replying, said the Chairman and Directors, though unavoidably absent, hoped the visit of the members would prove both pleasurable and profitable. Personally, he would rather the visit had been deferred until the new works had been completed and brought into use; but he well knew his late Chief was very anxious that during his occupancy of the presidential chair the members should visit the district in which he had so successfully laboured for many years. Therefore, he (the speaker) would presently take the President down and show him round the works which he (Mr. Branson) had so largely designed and which he had had so big a hand in constructing.

The New Gas-Works.

The party then proceeded to inspect, under the guidance of Mr. Jones and Mr. B. Grainger (the Engineer), the works which are now in course of erection. As the President pointed out in his address, the idea has been to centralize the manufacture at one new works at Caerphilly—stopping-down the old works there, and those at Hengoed and Pontlottyn. For some time past, the Company have been taking gas from the coke-ovens at Bargoed; and this source of supply has been found very satisfactory.

The excellence of the site and of the lay-out of the works was commented upon by the visitors. The coal gas will be made entirely by vertical retorts; the installation which is in course of erection being of the Glover-West type, of a capacity of 500,000 cubic feet per day, with a steel-framed coal-store to hold 1200 tons. There is also being put down an engine-house, to contain two Bryan-Donkin steam-driven exhausters, each of a capacity of 40,000 cubic feet per hour.

The only part of the manufacturing plant at the works which has so far been used is a Humphreys and Glasgow carburetted water-gas set, to produce 400,000 cubic feet of gas per day, complete with tar-extractor. Among the other plant on the works, there is a boiler-house containing two 18 feet by 6 feet Cornish boilers, a 20,000 gallon capacity underground tar and liquor well, annular and water-tube condensers, a Livesey washer, a tower-scrubber, four purifiers 20 feet square with self-sealing lids, a Braddock station-meter, a spiral-guided holder in steel tank of a capacity of 500,000 cubic feet, a governor-house and governor, a laboratory and photometer-house, and a works manager's house. A compressor of a capacity of 35,000 cubic feet per hour, for the purpose of ultimately delivering gas up the valley, has been fixed in the building which contains the blowers, exhausters, and oil and feed pumps belonging to the carburetted water-gas plant.

The whole of the buildings are in rough-course rubble stone work; the quoins, over-sailing courses, and all openings being finished off in blue bricks, and designed with a view to uniformity of appearance.

In laying-out the works, due regard has been had to future necessary extensions; and all connections have been so arranged that additions can be made without interfering with the operating of the plant. The site, of about 5 acres, is close to the railway, from which a siding into the works will ultimately be put down. The new works would by this time have been further advanced than is actually the case, had not the different contractors experienced difficulty in obtaining materials and labour, owing to the abnormal conditions prevailing.

A visit to the Castle ruins and tea—again as the guests of the Company—brought to a close a thoroughly successful day.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Coal Prices (Limitation) Act, 1915.

Sir,—On behalf of the members of the Lancashire Commercial Section, we have communicated with the Board of Trade, *re*

(*a*) The basis price for estimating the revised charge as allowed by the above Act.

(*b*) The legality of increasing waggon hire charges on existing contracts.

The following replies have been received; and, with the permission of the Board of Trade, we forward same for publication, as the matter is one of considerable interest to gas authorities throughout the country.

S. Meunier, Chairman.
S. E. Halliwell, Hon. Secretary.

Littleborough, Sept. 29, 1915.

[Enclosures.]

The enclosures referred to in the above communication are two letters, addressed to Mr. Halliwell by Mr. W. F. Marwood, writing from the Board of Trade (Railway Department), Whitehall Gardens. They are as follows:—

Sept. 20, 1915.

Sir,—In reply to your letter of the 9th of September, with regard to the question what is the corresponding price in the case of deliveries of "excepted coal" in respect of which notice has been given to the owner of the coal at the pits' mouth under the provisions of section 4 (2) of the Price of Coal (Limitation) Act, I am directed by the Board of Trade to point out that the question is one which the Board may be called upon to determine under section 3 (1) of the Act when referred to them by a Court of Law; and they must not therefore be understood as giving a final decision on the matter.

Subject to this, however, and apart from any special circumstances, it appears to them, after careful consideration, that, in the case of the coal above referred to, the corresponding price after the 29th of October will not be the price of coal sold otherwise than under contract, but will be the price of coal sold under a contract corresponding to that under which the deliveries are being made.

A reply to the other points raised in your letter will be forwarded to you shortly.—I am, &c.,

W. F. Marwood.

Sept. 22, 1915.

Sir,—With further reference to your letter of the 9th of September, inquiring whether the charges for waggon hire referred to in section 2 of the Price of Coal (Limitation) Act can legally be charged on contracts entered into before the passing of the Act, I am directed by the Board of Trade to say that, while they are not in a position to decide the legal question whether the giving of notice under section 4 (2) of the Act enables contractors to make increased charges for waggon hire, they are of opinion that the giving of such notice would not appear to affect any terms of contract other than the price of coal at the pits' mouth.—I am, &c.,

W. F. Marwood.

* * *

Impurities in Crude Gas.

Sir,—May I question the accuracy of the figures quoted on p. 700 of the "Journal" for Sept. 28 (*re* H_2S and CS_2 in crude gas), which figures form part of the paper contributed by Mr. Bell, of Derby, to the International Gas Congress at San Francisco?

I should like to suggest that they should read as follows:

SH_2, 700 to 1000 grains per 100 cubic feet.
CS_2, 30 to 70 grains per 100 cubic feet.

J. Hewett.

Brockley, S.E., Sept. 29, 1915.

[The abstract referred to by our correspondent was taken, as stated, from the official abstract of the paper, as appearing in the "American Gas Institute News."—Ed. J.G.L.]

MISCELLANEOUS NEWS.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

Half-Yearly Meeting.

The Half-Yearly Meeting of the Alliance and Dublin Consumers' Gas Company was held at the offices, D'Olier Street, Dublin, last Thursday—Mr. JOHN MURPHY (the Chairman) presiding.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN, in moving the adoption of the report [see "JOURNAL," Sept. 21, p. 658], said he wished, in the first instance, to express his deep regret, and that of his colleagues, at the loss sustained since the last half-yearly meeting through the death of their friend and fellow-Director, Mr. Tresilian, which occurred very unexpectedly. He was a man of exceptional business ability, who took a great interest in the affairs of the Company; his best exertions being always at its disposal. He begged, on behalf of himself and the Board, to tender respectful sympathy with Mrs. Tresilian and family. They would have observed from the report that Alderman Cotton, M.P., had resigned his seat on the Board; thus severing a connection which had extended over more than forty years—forty-seven years, to be correct.

COMPARISON OF ACCOUNTS.

On the last two occasions when he had the privilege of addressing the shareholders—twelve and six months ago respectively—he mentioned that, owing to the different form in which the statement of accounts was presented, comparison with the corresponding previous periods was impossible. This, however, no longer existed, and with the accounts now submitted, being identical in form with those of the corresponding period of 1914, comparison could be made as regarded every item; and he had no doubt but that such comparison had already been made by many of the shareholders, in whose hands the accounts had been for some considerable time. The total expenditure on capital account for the half year amounted to £8369, which included an item of £2225—a payment on account of the new coal-handling plant. There only remained the balance of £560 to complete the total cost of this plant. There had also been an expenditure during the half year of £1610 on the new 30-inch main in Barrow Street, to which he would refer later, when dealing with the works. He thought the other items of capital expenditure spoke for themselves. There were three deductions from capital expenditure for depreciation and sales of old material, amounting in all to £8187, leaving only £182 to be added to capital expenditure during the half year, which was satisfactory.

REVENUE ACCOUNT.

Turning to the revenue account, it would be observed that the revenue profit for the half year showed a marked increase of no less a sum than £35,398 over that of the corresponding half year. This large increase in profit was largely attributable to a reduction in expenditure on coal and oil of £10,239—notwithstanding the increases in the market price of the former commodity. The reduction had been effected by favourable contracts concluded some time since. There was also a substantial decrease in the charge for repairs of works, amounting to £5886. This had been achieved without any decrease in efficiency. A saving of £1980 on repairs of meters, and £2801 on repairs of stoves and fittings, had also been effected. In the former case, this was largely due to the alteration in the system hitherto in force, and, in the latter, to the transfer of the stove-repairing shop to a more suitable and very economical site on the works. There had also been a reduction in expenditure of £1062 on "Secretary, Accountant, and clerks." No expenditure had been incurred in parliamentary opposition or in fees for experts' reports; and these items accounted for a reduction of £3556 as compared with the corresponding period of 1914. It would also be noticed that no charge appeared against the revenue of this half year in respect of Officers' Superannuation Fund. This had resulted in a saving of £750; but it was the intention of the Directors to resume contributions to the fund at an early date. A war bonus had been granted, and certain allowances had been made to dependants of employees who had joined the Army and Navy, at a cost of £804 for the half year. On the credit side of the revenue account, while increases in certain directions had been obtained, there was a decrease in the sales of gas to ordinary consumers for the half year amounting to £2285. This was almost entirely due to restrictions imposed by the authorities in respect of licensed houses. It was gratifying, however, to point out that the income from sales of gas to prepayment consumers showed an increase of £1381; while the public lighting remained at about the same figure. The income from residuals showed a satisfactory increase of £6417 in respect of sales of coke and breeze; £2568 on tar; and £1318 on sulphate of ammonia. Passing on to the net revenue account, it would be observed that a further amount had been written off ordinary and prepayment meters, amounting to £4083 and that a year's contribution of 10s. per cent. (or £8119) on the capital had been allocated to the special purposes fund.

SPECIAL PURPOSES.

The special purposes fund showed that they had now £16,240 under this head available for certain purposes. The fund had been created since that time twelve months ago. The three items—bills payable, bank overdrafts, and sundry creditors—amounted at June 30, 1914, to £128,162, whereas the corresponding items this half year amounted only to £70,194—a decrease of £57,968. On the other side of the balance-sheet, the stocks on hand showed an increase of £9181. It was a matter of satisfaction that the Directors were able on this occasion to recommend the payment of the maximum statutory dividend—namely, £5 2s. 6d. per cent. per annum, less income-tax—without having been, so far, obliged to increase the price of gas.

WORKS AND PLANT.

With regard to the works, he had already mentioned in passing the new coal-handling plant, and the new 30-inch main, to which he referred at the last half-yearly meeting. Both were completed and in operation. The first cargo dealt with by the former was on May 2 last, so that the accounts under review had only benefited slightly by its use. The plant had fully realized anticipations; and they looked forward to a substantial reduction in the expense of handling the coal. The estimated cost of the plant—namely, £4000—had not been exceeded. The coal was unloaded by means of grabs, operated by a travelling crane, running on a double line of rails fixed on an overhead gantry. It was then delivered from the grabs into an overhead hopper, underneath which there was an automatic weighing machine. After being weighed, the coal was delivered on to a push-plate conveyor, and passed directly into the coal-stores. The wages cost per ton of coal so handled averaged under 1½d. per ton, and, making liberal allowances for the cost of repairs and depreciation, interest on capital, &c., the cost would not exceed 3d. per ton. This, they would easily understand, represented a very substantial saving on the old method of handling the coal by means of tip waggons; and, as far as possible, the greater part of their coal would be eventually dealt with by the new plant. He took the opportunity of mentioning that they had at present over 25,000 tons of coal in stock, in anticipation of the winter's needs. They fully realized the necessity of keeping considerably larger stocks of coal and oil now than under normal conditions. The matter was constantly before the Board, and received every attention.

THE NEW MAIN AND PRESSURE STATION.

As to the laying of the new 30-inch main, this was a work entailing very considerable difficulties, owing to the presence of water in the excavations and the making of the connections to the Clayton and Alliance holders. He was glad to say, however, that these difficulties were successfully overcome, at a cost not exceeding the estimated expenditure. The result of the laying of this main was a marked improvement in the gas supplied to the city. A set of charts had been furnished that showed the improvements intimated. He was glad also to state that the reconstruction of the pressure station was now completed, and that the station governors were working satisfactorily. This, again, was a work causing much anxiety, as they would realize when he said it included the removal of the old station governors and the installation of six new governors—five of which were 24-inch diameter and one 18-inch, together with the coupling up to the 30-inch trunk main and to the other holder connections. The work was successfully carried out by Messrs. J. & J. Braddock, of Oldham, under the personal attention of their representative, Mr. Taylor.

TOLUENE PRODUCTION.

Acting immediately on the suggestion and recommendations of Lord Moulton's Committee on explosives, the Directors took the necessary steps to increase the production of toluene. The results, under the present abnormal conditions, were gratifying—although not, perhaps, of financial benefit. Nevertheless, the Company's obligations in the matter of candle power had been fully maintained, and it was satisfactory to think that they were contributing their quota in a direction so pressing.

DISTRIBUTION.

The Company's distribution returns had at times been adversely criticized; but it should be remembered that Dublin had special difficulties to contend against, with long lengths of mains and services, a huge area to cover, a limited number of consumers per mile of main, and a small consumption per consumer. However, with a view to improving a department which admittedly bore unfavourable comparison with undertakings more favourably situated, the Board had appointed a Distribution Committee, consisting of some of their members, with a view to assisting the distribution officials in their work of re-organization; and they anticipated good results.

TRIBUTES TO OFFICIALS.

He could not conclude his remarks without paying a special tribute to their Consulting Engineer, Mr. Newbigging, whose efforts in placing the works on a proper basis had been unremitting, and, he was very glad to say, uniformly successful. He also wished to refer to the able services rendered by their Secretary, Mr. W. J. Grey, and their Works Manager, Mr. H. Dumbleton, in their respective departments; and to the loyal assistance given by every member of the staff.

RECOGNIZING THE SERVICE OF THE ENGLISH DIRECTORS.

Referring to the special business to be brought forward, in accordance with the notice convening the meeting, the Chairman said that a number of prominent shareholders having expressed the view that special recognition should be made to the services rendered by those Directors who resided in England, a motion in accordance with the notice would be proposed. He wished to state, on behalf of himself and the Directors not concerned, that they were in entire sympathy with, and approval of, the course proposed. Mr. Dickens, Mr. Bond, and Mr. Davies were gentlemen having important business interests on the other side of the Channel; but, notwithstanding this, they had been unremitting in their attendances at the regular meetings of the Board during the past twelve months, in spite of the inconvenience of crossing to Dublin in the depth of winter. They had also, on several occasions, spent days together in Dublin, closely examining the various departments of the Company's business; and, on the other side of the water, their assistance—especially as regarded purchases of coal—had been of great value. He trusted, therefore, that the motion, when proposed, would be unanimously adopted.

AN ENGLISH DIRECTOR'S REMARKS.

Mr. AUGUSTINE BOND, in seconding the motion, desired to identify himself with the remarks of the Chairman. He ventured to say at once that he regarded the position disclosed by the accounts as particularly satisfactory, and, if comparison was made with previous half years, he thought they would agree that it was most gratifying. The position with them was, he believed, entirely unique, because, in spite of increased costs of materials and wages in all directions, they had, without transferring these burdens on to the shoulders of the consumers, substantially increased their revenue profit, enabling them to pay the maximum statutory dividend. They did not expect that their finances would be materially affected by the Price of Coal (Limitation) Act, 1915, as only a small proportion of their requirements came within ne retrospective scope of this Act; and, moreover, the contracts were nade at such prices that there was every likelihood of the collieries nd the contractors concerned being able to justify them.

THE SHOW-ROOMS.

fter very careful and anxious investigation, the Directors had decided close the Grafton Street show-rooms; and they were pleased to inorm the stockholders that they had relet the premises at an advanageous rental. They intended to erect up-to-date show-rooms adoining the Head Office in D'Olier Street, which they considered to e a more convenient site, and more readily accessible to consumers isiting the offices. The cost of these alterations would amount to 1500. They had also opened show-rooms at Kingstown. As shareolders were aware, they had already vacated the premises in Hawkins' Street formerly used as a stove-repairing department. Negotiations were n progress for the letting of these premises for a term of years, at an dequate rent. They desired to point out that there was a very suitble site for trade or business, with a frontage of over 80 feet on Sir John Rogerson's Quay and 280 feet on Cardiff Lane, part of the works site at present used as a coal-store; and they would be happy o treat for the tenancy of these premises, which, in every respect, would end themselves to any business requiring a deep-water berth.

PRICE REDUCTION.

In recommending payment of the maximum statutory dividend, he remarked, as previously mentioned by the Chairman, that this absorbed the sum of £39,766 This amount, as it would occur to them, would increase the bank overdraft to a figure of £64,000. This, however, would be materially reduced as time went on. As mentioned in the report, they had in the Bray district made a reduction of 5d. per 1000 cubic feet in the price of gas, and they had also put into operation a graduated scale showing considerable reductions to consumers using gas for power and manufacturing purposes. This reduction, they were confident, would encourage manufacturers and traders to extend their businesses on satisfactory and economical lines.

BACK-DIVIDENDS.

He understood some doubt existed in the minds of certain shareholders with reference to the question of making up arrears of back-dividends; but he felt sure these shareholders had overlooked the fact that this was not a maximum dividend company, but a company working under the provisions of a sliding-scale, and, therefore, in their case, there could be no question of making up any arrears of dividends in past periods, as they were precluded from so doing by the Act of Parliament.

CAPITAL EXPENDITURE.

The Chairman had referred to the fact that they had only added to capital expenditure this half year to the extent of £182. The Directors felt confident that, during the present half year, there was at least a possibility of the present figure of capital expenditure being reduced, rather than any sum added to it. This, he thought, would be regarded as satisfactory, considering all the circumstances. It was interesting also to note in this connection that, whereas on the 31st of December, 1913, the capital account was overdrawn to the extent of £68,412, it now showed a debit balance of only £50,946. They would see from this that the amount written off, and the sales of old material, had substantially exceeded the capital expenditure during the last eighteen months. In conclusion, Mr. Bond referred to the recent death, in action, of Lieut. Nesbitt, 6th Battalion Dublin Fusiliers, who had for 27 years been a prominent and much-valued servant of the Company, and extended sympathy to his family.

The motion was unanimously passed.

THE DIVIDEND.

On the motion of the CHAIRMAN, seconded by Mr. J. L. SCALLAN, a dividend of £5 2s. 6d. per cent. per annum, less income-tax, was declared.

ENGLISH DIRECTORS' REMUNERATION.

Mr. M. K. ROCHE moved: "That a sum of £1000 be divided among Messrs. Dickens, Bond, and Davies, as remuneration for their past special services to the Company, and that the sum available for the remuneration of the Directors be increased by the provision of a further sum of £500 per annum." He said he was sure the shareholders felt under a great obligation to the gentlemen from England, whose influence and ability had been used to such excellent purpose in bringing the Company to its present state of prosperity. He contrasted the present position with that which had previously existed, alluded to the time and trouble involved in re-organization, to the efforts of the officials, including Mr. Grey, in support of the Directors, and to the efficiency with which the work of all departments was now being carried out. The shareholders, he said, should not—and he knew they would not—grudge the recognition that was proposed of the services of the Directors from England, who had placed the concern in a position which they had not looked to see it in in so short a time. He urged that it was their duty to encourage the Board in the enterprising methods which had been adopted, and he hoped that they would continue to have such satisfactory reports and such excellent results.

Mr. G. W. NORMAN, in seconding, endorsed the remarks of the previous speaker, and observed upon the small attendance of shareholders as a hopeful sign—a sign that confidence was reposed in the Board—and that the period of prosperity which had arrived would continue. He joined in the tribute to the officials and to the staffs in all departments, and referred in felicitous terms to Mr. Grey's ability and usefulness in the working of the undertaking.

The motion was passed unanimously.

ACKNOWLEDGMENTS.

Mr. W. H. DAVIES acknowledged the kindness of the shareholders on his own behalf, as well as on behalf of Messrs. Bond and Dickens. He assured them that it had been a great pleasure to them to come there and help in doing all that could be done to promote the success of the Company and its works. He wished to say that there was no foundation for the rumour that they (the Directors from England) intended to leave the concern—that they were not going to continue the work in which they had been engaged. They intended to remain, and it would be their duty, as it would be a pleasure to them, to devote their best energies to the interests of the shareholders. He also joined in the tributes paid to the officials and staff, and said they placed the highest value on the co-operation that had been of so great assistance to them and on the goodwill extended by all.

Mr. GREY expressed his gratitude to those who had spoken in so kindly a spirit of himself. He was greatly pleased, indeed, that the results of the working had been so satisfactory. His own services would have been of small importance, after all, he felt, but for the manner in which he was supported by all the departments. He had had the most loyal help from all—from the higher officials to the workmen in even the very minor grades. It had been a pleasure to him to work with them; their devotion to duty and anxiety to promote the common interest surpassing, indeed, anything he had ever experienced. He added that he found Irishmen extremely loyal to work, and that he had only to make a suggestion and it was carried out with every promptitude.

VOTE OF THANKS.

Thanks were afterwards formally voted to the Chairman, Directors, officials, and general staff—members of the shareholding body declaring their gratitude for all that had been done, and stating that they looked forward to continued good results.

BRITISH GASLIGHT COMPANY, LIMITED.

Half-Yearly Meeting.

The Ordinary Half-Yearly General Meeting of the Company was held last Wednesday, at the London Offices, No. 11, George Yard, Lombard Street, E.C.—Sir CORBET WOODALL, D.Sc., in the chair.

The SECRETARY (Mr. A. W. Brookes) read the notice convening the meeting and the Directors' report. The accounts and the financial statement referring to the Norwich station were taken as read. The Auditors' report and that of the Norwich Corporation Auditor were read. The report of the Directors was as follows:

The Directors submit the half-yearly accounts of the Company to the 30th of June last, as examined and certified by the Auditors, who have also vouched for the correctness of the investments held by the Company.

The available profit is £33,574 6s. 1d., after deducting the following sums: Income-tax, £3628 13s. 4d.; Hull debenture interest, £2015 12s. 6d.; Norwich debenture interest, £1693 2s. 6d.; Potteries debenture interest, £627 1s. 8d.; Trowbridge debenture interest, £156 15s. 5d.; interest on debenture stock, £2150—total, £10,271 5s. 5d.

HULL.—The gas-rental shows a decrease of £32 as compared with the corresponding period of 1914; the price of gas having been increased from 1s. 10d. to 2s. 1d. per 1000 cubic feet from the 1st of April. Coke shows a decrease of £1440; tar and tar distilling, £1916; and ammoniacal liquor and sulphate of ammonia, £402—these decreases being principally attributable to the lesser quantity of coals carbonized. Coals have cost 16s. 10d. per ton, as against 15s. 10d. Coke has realized 11s. 9d. per ton, as against 11s. 5½d. The gas sold shows a decrease of 42,815,895 cubic feet, equal to 5·49 per cent. The quantity sold in bulk to the Corporation for the supply of the Old Town was 37,770,000 cubic feet; being 5,064,000 cubic feet, or 11·82 per cent., less than in the same period of 1914. Exceptional expenses have amounted to £3715; the principal item being £2000 on account of the reconstruction of No. 3 retort-house. After charging these against the half-year's revenue, the profit realized is £15,448 1s. 9d.; being £4893 2s. 8d. less than the parliamentary interest. The deficiency will be drawn from the reserve fund; leaving £15,913 15s. 9d. to the credit of that account.

NORWICH.—The gas-rental shows an increase of £736 as compared with that of the corresponding period of 1914, the price of gas having been the same—viz., 2s. 10d. per 1000 cubic feet, with reductions for gas used for manufacturing and other special purposes. Coke shows a decrease of £892, and tar, tar distilling, and ammoniacal liquor a decrease of £626. Coals have cost 21s. per ton, as against 19s. 1d. Coke has realized 17s. 8d. per ton, against 17s. 9d. Gas sold shows the small decrease of 84,154 cubic feet, equal to 0·03 per cent. The profit realized is £2351 2s. 2d. in excess of the parliamentary interest.

POTTERIES.—The gas-rental shows a decrease of £699 as compared with that of the corresponding period of 1914; the price of gas having been the same—viz., 2s. 6d. per 1000 cubic feet, with a rebate of 3d. for prompt payment, and special discounts to large consumers and consumers of gas for power purposes. Coke shows an increase of £594; tar, a decrease of £977; and ammoniacal liquor and sulphate of ammonia, an increase of £39. Coals have cost 14s. 3d. per ton, as against 13s. 10d. Coke has realized 10s. per ton, as against 11s. 1d. The gas sold shows a decrease of 7,035,617 cubic feet, equal to 3·36 per cent. The profit realized is £300 8s. 3d. less than the parliamentary interest.

TROWBRIDGE.—The gas-rental shows an increase of £469 as compared with that of the corresponding period of 1914; the price of gas having been the same—viz., 3s. per 1000 cubic feet, with discounts. Residual products show an increase of £435. Coals have cost 17s. 10d. per ton, as against 18s. 6d. Coke has realized 15s. 3d. per ton, as against 12s. 11d. The gas sold shows an increase of 2,503,228 cubic feet, equal to 7·26 per cent. The profit realized is £266 0s. 6d. in excess of the parliamentary interest.

HOLYWELL.—The gas-rental shows a net decrease of £23; the price of gas having been the same—viz., 4s. 2d. per 1000 cubic feet, with discounts. Residual products show an increase of £45. The profit realized is £315 7s.

The available profit, added to the previous balance of profit and loss, amounts to £107,191 4s. 7d. From this sum the Directors recommend a dividend at the rate of 10 per cent. per annum, with a bonus of 2s. 6d. per share, both less income-tax. The dividend and bonus will amount to £28,650 1s. 11d., and leave a balance of £78,541 2s. 8d.

The Directors who retire by rotation are Major-General William T. Corrie and Mr. Lewis R. Abbey-Williams; the Auditors are Mr. E. Knowles Corrie and Mr. William Cash. They respectively offer themselves for re-election.

EFFECTS OF THE WAR.

The CHAIRMAN, in moving the adoption of the report and accounts, said: At the close of the second half year of working under war conditions, I am glad to have a report so comparatively favourable to present to you. Generally speaking, circumstances have been against us. The cost of materials used, with the exception of oil, has been higher; the quantity of gas sold materially less; and the revenue from residuals less also. Greater expense has had to be met out of reduced income. The conditions at the various stations differ. At Hull, our largest station, the output of gas has fallen by 5½ per cent. in the Company's district and by 12 per cent. in the Old Town. For the latter, we supply gas in bulk to the Corporation, who, in turn, undertake its distribution. The enemy air-raids have probably induced some inhabitants to sleep out of town. The restrictions upon public and outside lighting have been very stringent; and the trade of the City has doubtless suffered. In the months of July and August, the consumption was less by some 11 per cent.; but I am glad to say that there seems to be a turn for the better now. Notwithstanding these drawbacks, the profit for the half year has been better by £2000 than in the corresponding half of 1914, though still less by £4893 than the sum we are entitled to divide. There have been exceptional charges for renewals during the half year; but for these, the balance would have very nearly met the dividend.

THE POSITION AT HULL.

As I mentioned six months back, the capital expenditure at Hull has been very heavy recently, due to the reconstruction and enlargement of the works to meet a steadily increasing consumption of gas; and because of this, the charge for dividend has been largely increased. It is unfortunate that, having made this provision, the station should be the chief sufferer with respect to reduced sales occasioned by the war. As illustrating this, I may mention that in 1910 the output of gas at Hull was 636 million cubic feet; while in 1914—in four years—it had gone up to 780 millions. The capital had gone up by £86,000, and the charge for dividend had fallen from 6·5d. to 5·8d.; but in the last year the consumption fell by 43 millions, the capital by £40,000 nearly, and the capital per 1000 cubic feet increased by 2s. The interest rose to 6·6d., or from £17,000 in 1910 to £20,000. So that, while everything was perfectly right and proper until the current year, the falling away of the consumption has made the actual charge for dividend per 1000 cubic feet much higher. The reduction of gas-rental during the half year amounted to £3182. This was neutralized by an increase of price which took effect from the 1st of April, and brought in an additional £3150. The effect of transferring from the Hull reserve fund to the general profit and loss account the deficiency of £4893 will be to increase by this amount the balance remaining to the credit of profit and loss, as the half-year's earnings are sufficient without help to meet the dividend and bonus which it is proposed to pay.

SATISFACTORY RESULTS AT NORWICH.

The results at Norwich are very satisfactory, as they show a profit of £2350 more than the parliamentary interest. Although the full effect of the increased cost of coal and freight has not yet been felt, the charge against the half year has been considerable; for, in spite of the fact that the quantity of coal carbonized was 1260 tons less than in the corresponding half of 1914, the cost was £500 more. At last year's price it would have been £1200 less; so that there is a difference of £1700 against the working. The surplus profit will reduce the deficiencies of interest in past years, and is available for dividend. Troops have been billetted in Norwich, and the trade of the City was otherwise good.

POTTERIES AND TROWBRIDGE STATIONS.

In the Potteries the receipts were £900 less than in the same half of 1914; but the expenditure was £2800 less. The profit thus shows an increase of nearly £2000, and is only £300 short of the parliamentary interest. At Trowbridge, the half-year's profit shows a marked advance upon that of the corresponding half year, and is £266 in excess of the authorized interest. The quantity of gas sold has increased, and residuals have brought higher prices. Here, as at Norwich, the quartering of troops in the neighbourhood and abundant work for the Government have aided in producing the good result.

COAL AND FREIGHTS—THE OUTLOOK.

Over the whole undertaking the net decrease in the quantity of gas sold has been 47½ million cubic feet, or 3·64 per cent. Comparing the position of the Company, and of the gas industry generally, with what it was six months ago, there is room for congratulation. We have to acknowledge, and we do so gratefully, the prompt and efficient aid given by the Government when the conditions obtaining were brought fully home to them. First, the provision of interned enemy ships to carry coal to London helped considerably to abate the extravagant charges which were being made for freight. The help would have been greater had the Board of Trade resisted the temptation to make war profits when they became carriers. Secondly, by limiting the export of coal, the threat of famine was removed. I apprehend that at present the stocks held by undertakings through the country are rather above than below the normal. Thirdly, by the passing of the Price of Coal (Limitation) Act, we have been saved from the risk of prices so high as to be an insufferable burden to suppliers and consumers. The Act is not easy of interpretation, especially as some of the parties interested are not disposed to help an understanding. The intention of the Legislature is clear; but it may be necessary to seek in the Law Courts a definite pronouncement on certain points. But, meantime, we can be thankful that the Act has removed the nightmare which oppressed us a few months ago. We shall still have to pay high prices; but we know the limit, and shall be able to make arrangements accordingly. Further, the workmen, knowing that the owners have no longer unlimited power as to prices, will be more reasonable in their demands and their methods of enforcing them. We may hope to be saved the infinite shame of again seeing men standing idle whose best service is needed to secure the safety and triumph of their country.

THE DIVIDEND.

I expressed my belief when we last met here that the dividend and bonus then declared would be repeated; and the Directors are pleased, as I hope you will be also, to see that my expectation has been realized. What may be in front of us it is impossible to forecast; but we see no present reason for anxiety.

EMPLOYEES WITH THE FORCES.

The last report stated the number of employees who had joined His Majesty's Forces at 179; the number now stands at 235. At all our works material for the manufacture of high explosives is now being produced.

INCREASE IN THE PRICE OF GAS.

In view of the still increasing cost of gas manufacture, it has been found necessary to advance the charge to ordinary consumers at all the towns our Company supplies—viz.: Hull, 3d. per 1000 cubic feet; Norwich, 2d.; the Potteries, 6d.; Trowbridge, 5d.; and Holywell, 6d. to 4d. We hope soon to be able to reduce or remove these burdens, which we have been most reluctantly obliged to impose.

THE RECENT CAPITAL ISSUE.

In April last 2000 additional shares were offered to the proprietors at the price of £38 per share. Of these, 72 remain unallotted; and the Directors invite applications for them before Oct. 30. Allotments made before that date will carry dividend to Dec. 31. The Directors recommend the declaration of a dividend at the rate of 10 per cent. per annum, together with a bonus of 2s. 6d. per share, both less income-tax. This will require £28,650, and will leave a balance of £78,541.

Mr. Frederick Wilkin having seconded the motion,

Mr. J. Chamberlain, as a matter of interest, asked if any of the Company's stations had suffered damage from the recent air-raids.

The Chairman replied in the negative.

The motion for the adoption of the report and accounts was unanimously agreed to.

Dividends and Re-Elections.

Moved by the Chairman, and seconded by Mr. Frederick Wilkin, a dividend at the rate of 20s. per share, and a bonus of 2s. 6d. per share, for the half year ended June 30, both less income-tax, were declared.

Proposed by the Chairman, and seconded respectively by Mr. R. S. Gardiner and Mr. Wilkin, Major-General William T. Corrie and Mr. L. R. Abbey-Williams were re-elected on the Board.

Proposed by Mr. Kenneth R. Mackay and seconded by Mr. Charles Webb, Mr. E. Knowles Corrie was re-appointed an Auditor, as was also Mr. William Cash, F.C.A., on the motion of Mr. Henry Pullman, seconded by Mr. B. F. Harris.

Votes of Thanks.

Mr. Pullman said he regretted that he did not have any personal acquaintance with his colleagues on that side of the table; but he was sure he would be voicing their sentiments when he said that they were all deeply indebted to the Board, and especially to the Chairman, for the very lucid explanation he had given of an eminently satisfactory balance-sheet with regard to which there had not been a word of criticism offered at the meeting. From his experience over many years in the management of gas companies, the Chairman and his colleagues were to be congratulated on having brought forward such a satisfactory balance-sheet under adverse circumstances. The shareholders cordially thanked the Board and the staff for their very arduous and serious devotion to their interests during the past year.

Mr. Richard Stevens seconded the motion, which was put and carried unanimously.

The Chairman, in responding on behalf of his colleagues and himself, said it was unnecessary to say that the Company had passed through a trying time and were not yet by any means out of the period when the same could be said. But they were pleased to have so good a report to present, which he hoped they would continue in a position to do. They would certainly do their best in this direction. The fact that they had been able to present such a good report was due very largely indeed to the manner in which they had been served by their officers at the different stations, and by their Secretary and his staff at home. He had spoken strongly about the obligations that they were under to their friend Mr. Brookes on more than one occasion, and all he could say was that the standard that that gentleman had set up long ago he had maintained thoroughly, and that a better Secretary no company could desire to have. With regard to the officers at the works—the commercial side as well as the engineering—their work had been of a most trying and absorbing character. The alterations in the values of what they had to buy and what they had to sell had been perplexing and difficult; but throughout they had done well. One had to be careful in comparing reports from the different stations not to set down the fact that one man had earned more than the necessary sum to pay the statutory dividend, while others had earned less, as attributable to any fault on the part of one, or special ability on the part of others. All of them had done their best; and there was nothing in the result of their work which could be criticized adversely. He would, therefore, with great satisfaction propose that the best thanks of the proprietors be given to the Secretary, to the Engineers, and to the staff generally, for their services during the past half year.

Mr. L. R. Abbey-Williams seconded the motion, which was at once heartily carried.

The Secretary, in responding on behalf of all included in the vote, thanked the Chairman for what he had said. It had been a trying time for all officials of gas companies. Their Engineers had had to contend with high costs of coal and all materials, increased wages, and severe restrictions with regard to lighting. Also the reduction of their staffs through enlistment had added considerably to the work in every department. At times, there must have been at some of their works additional cause for anxiety by reason of the situation of the works. In a lesser degree the pressure of work had been felt in the London office; and he was very glad to have the opportunity of acknowledging the willing help which he had received from all officials there. At times such as the present it was gratifying to receive this vote of thanks, and he was sure it would be specially welcomed by all concerned.

Quality of Sheffield Gas.—The representatives of the Sheffield City Council upon the Board of Directors of the Sheffield United Gas Light Company report that the quality of gas supplied during last year was above the required standard, that considerable extensions have been made, and that the whole of the plant and service mains have been well and efficiently maintained. As compared with 1913, the gas sold during 1914 showed an increase of 2 per cent. The industrial and clerical staff of the Company has been depleted by the war, no less than 343 men having joined the forces.

TRAGIC DEATH OF THE COWES GAS MANAGER.

Accelerated by Gas Poisoning.

Mr. E. H. Millard, the Manager of the Cowes Gas-Works, passed vay with tragic suddenness on Monday last week. He went to work at morning, apparently in good health, and had been engaged super- tending the installation of a new governor in the retort-house, when e complained of a pain in his chest. He went to his house, where he uickly sank and passed away before the arrival of a doctor.

An inquest was held on Wednesday, by the Isle of Wight Deputy-Coroner (Mr. F. A. Joyce).

Mr. Edward Smith, an engineer in the employ of Messrs. Waller and on, of Stroud, said he had been putting a new governor in the retort-ouse. The deceased, who assisted him in every possible way, enjoyed pretty good health, and had not complained about anything. Witness was not at the gas-works when deceased was taken ill, as he was bad himself, suffering from the effects of gas poisoning, the same s Mr. Millard. He was with the deceased at the works on Saturday, when they were both taken ill. On Sunday they were both ill for two ours. They were bound to have it bad, as they had to cut a pipe and ut some connections in, and had gas from a 6-inch pipe down on hem all the time. As far as he knew, they were both in good health p to Saturday. The gas from the pipe came straight from the retort, and was very foul.

Mr. T. W. Hudson, a clerk employed at the gas-works, said he was t the works with the deceased on Monday. Mr. Millard was walking rom the retort-house to the valve-room, when witness approached him, and said, “ What is the matter ? ” Deceased was looking ill, and was in a bath of perspiration. He placed his hands on his chest and omplained of pain. Witness asked him what was the matter, and he eplied indigestion. He said he had been up over the retorts, which accounted for his perspiration. He had been worrying about the de- ay in this work. Deceased did not suggest that his illness was due to gas poisoning or an escape of gas.

Mrs. Millard said her husband had been in splendid health during he last two years, and made no complaint whatever. When he returned home, at about 10 o'clock on Monday morning, he said, “ What a dreadful pain I have. I have indigestion.” He went straight upstairs and was sick, and afterwards went to bed. He put his hand across his chest and said, “ It's that foul gas.” He had often complained about he gas. She went downstairs, and on returning to the bed-room found him looking very strange. He died shortly afterwards. He complained of the gas twice, either on Saturday or Sunday ; but she did not take any notice of it, as she heard him do it frequently when there had been alterations. Deceased had not been attended for heart trouble.

Dr. T. A. Mayo said when he arrived at the house, about 11 a.m., he found deceased dead in bed. He was unable to state the cause of death, and had made a post-mortem examination. He found some slight calcareous changes in the arteries of the heart. From the examination of the body, there was not sufficient evidence to account for death, apart from sudden heart failure. The only point in favour of gas poisoning was the rather bright colouring of the body, which was evidence of carbon monoxide poisoning. The whole thing was very indefinite ; but there was so little alteration to the heart from the normal that the evidence strongly suggested that death was accelerated by gas poisoning. One could have a chronic condition of gas poisoning leading to general depression of health. It was his firm opinion that death was accelerated by gas poisoning. It might accelerate or bring on angina pectoris, which otherwise he might not have had for years. He was a man who would probably have an attack of angina at some time or other.

The Coroner said the evidence with regard to gas poisoning was not absolutely convincing ; and he thought the Jury should leave it open a little to doubt. He suggested that death was probably accelerated by gas poisoning. There was no evidence of any gas poisoning other than the fact which the widow referred to with regard to deceased vomiting when he returned home. There did not appear to have been much complaint made by the deceased about the gas ; and only two persons connected with the works seemed to have suffered from the effects of it.

The Jury returned a verdict of “ Death from angina pectoris, accelerated by gas poisoning ; ” and the foreman expressed deep sympathy with the widow and bereaved family.

Mr. Damant (the Clerk) also expressed the great regret of the District Council, and their appreciation of the deceased's many years' excellent service.

PROPOSED EXTENSIONS AT LANCASTER.

Sir Norval W. Helme, M.P., the Chairman of the Gas Committee of the Lancaster Corporation, brought forward important proposals for the development of the works, at a meeting of the Town Council last Wednesday. The minutes recorded that, upon a report from the Engineer (Mr. Cecil Armitage) as to the extension of works required, in view of the probable large increase in the consumption of gas, the Finance Committee were recommended to apply to the Local Government Board for a Provisional Order authorizing the Committee to obtain borrowing powers for the sum of £80,000, for the extension of the gas-works ; such borrowing powers to be exercised as may be necessary, and at such times as the Council and the Government Departments concerned may sanction.

Sir Norval said that five years ago Mr. Armitage pressed upon them the absolute necessity of providing for an increase of the producing plant ; and a scheme was brought forward to cost £35,000. Circumstances were not, however, favourable to the expenditure of so large a sum, and an extension of producing power was obtained by the introduction of a larger size of retorts. All the developments at the works had been secured out of profits, except for £6700 ; and the price of gas had been reduced from 4s. 6d. per 1000 cubic feet to 1s. 10d.. or 1s. for large quantities for motive power. They had contributed £72,500 towards the development of the works, and £59,243 in relief of rates. The whole of their capital powers of £140,215 had been expended, except £1366. Important undertakings were coming to Lancaster ; and they proposed to put up a new chimney and increase the carbonizing capacity, at a cost of £10,000. With winter coming on, they could not pull out their retorts, but they could quickly extend the production by erecting carburetted water-gas plant, which they proposed to do at a cost of £7000. He put the matter before the authorities in London, who recognized the urgency of the work ; and though it was found impossible to proceed without a Provisional Order, assurance was given that, upon the deposit of the plans, the work would be able to proceed in anticipation of parliamentary sanction. In taking powers for the larger sum, the cost of a second application would be avoided. They were not asking for permission to spend £80,000, or to borrow anything more than the capital required for the immediate extension which was forced upon them. With regard to the £10,000 needed, he pointed out that, under the new arrangement of debt, it was required that £10,000 which they had as a reserve should be transferred to a working balance. If they had had this £10,000, they would not have required to borrow for the renewal and extension of the retorts.

After discussion, the proposal was unanimously carried.

On the recommendation of the Finance Committee, a further resolution was passed authorizing an application for permission to borrow £27,000 for gas-works purposes—viz., £17,000 for extension of works, and £10,000 to replace the reserve fund.

BIRKENHEAD AND ITS CORPORATION PROPERTY.

Position of the Council's Undertakings.

Mr. Thomas Sumner, the Birkenhead Borough Treasurer, has furnished the Town Council with an abstract of the accounts up to the end of the last financial year. It shows an expenditure amounting to £233,654 ; income, £222,709 ; expenditure in excess of income, £10,944. Five Committees between them spent £1154 beyond the estimate ; and the Gas Committee's income was £10,499 less than estimated. The Local Government Board inquiry into the borough extension cost £4384 ; but the Board state that they have no power to sanction a loan in respect of expenditure of this nature until the total amount of the costs has first been sanctioned as reasonable. The capital outlay for all purposes amounted to £3,700,269 ; and the total debt was £2,485,149 —an increase of £70,958. The amount provided for the repayment of loans now stands at £1,340,688 ; the increase being £80,906.

The capital outlay on the gas undertaking was £579,164 ; and the total debt, £376,183. The gross working profit was £25,365, against £36,494, a decrease of £11,129.

The water-works accounts showed an increased income of £10,805, which was attributable to the higher charges for water, and the increased consumption for trade purposes and shipping. The new works capital account showed an expenditure during the year of £83,265, increasing the total outlay on the new water scheme to £400,600.

The total income of the electricity undertaking was £42,151—an increase of £1621 ; and as regarded expenditure there had been a net reduction of £893. The outstanding debt on the undertaking was £137,567.

The total amount derived from the general district and interest rate was £125,755 ; and the total amount of the poor-rate was £135,395. In eight years the rateable value of the borough for poor-rate purposes has increased by £54,419.

LIGHTING AND HEATING OF COTTON-MILLS.

Professor Benjamin Moore, F.R.S., delivered a lecture at Oldham last month, under the auspices of the Oldham Workers' Educational Association, in the course of which he dealt with the question of lighting in cotton-mills, and suggested several important improvements from a health point of view.

Professor Moore said a great deal of inside work in cotton-mills produced fatigue which was due in a measure to imperfect lighting and bad air. This was at the root of much of the unrest in the country. Workers became peevish and irritable over quite trivial things. The State had done a great deal to improve the workers' conditions, by the regulation of hours and Factory Acts generally ; but the question was whether present conditions could be improved. Light was one of the most important influences for the prevention of disease. This was a reason why open air employment was more healthy than inside work. Few people who constructed mills and factories knew how to manipulate artificial light in the buildings. Most people, in reading a book, thought their eyes ought to be illuminated ; and in factories artificial light fell on the workers, and dazzled them, instead of falling upon the work they were engaged upon. The better the eyes were protected or darkened, and the better the work was illuminated, the more work would be done.

After a reference to the importance of ventilation in factories, Professor Moore said he had noticed in many mills that the heating apparatus was installed on a level with the heads of the workers, so that in winter time the floor was excessively cold, and the operatives were scarcely able to work at all. The heating apparatus should be as nearly as possible at the foot level.

Alleged Smoke Nuisance.—The Southend Corporation have received a letter from the Local Government Board enclosing a copy of a communication sent to them in regard to a nuisance alleged to arise at the Gas Company's works from the emission of black smoke from the shafts, retort-houses, and locomotive engines. The letter has been considered by the Health Committee, and instructions have been given to the Town Clerk in reference to it.

INCOME-TAX DEDUCTIONS ON DIVIDENDS.

The Board of Inland Revenue, on the 23rd ult., issued a memorandum as to the deduction of income-tax for the year 1915-16 from payments made after to-day (Oct. 5). It is as follows:

By virtue of a resolution of the House of Commons passed in Committee of Ways and Means on the 21st inst., and having statutory effect under the provisions of the Provisional Collection of Taxes Act, 1913, such deductions of income-tax are to be made in the case of dividends, interest, or other annual sums due or payable after the 5th of October, 1915, as will make the total amount deducted in respect of income-tax for the year equal to that which would have been deducted if income-tax for the year had been at the rate of 3s.

The cases in which deductions have to be made in pursuance of this resolution fall into two main classes.

Class I.—Payments which are not made out of profits or gains brought into charge to income-tax.

This class comprises:

(*a*) Dividends and interest from the public funds payable between the 6th of October, 1915, and the 5th of April, 1916, both dates inclusive.

(*b*) Dividends and interest of foreign or colonial government securities, or of foreign or colonial companies, entrusted to an agent in this country for payment here between the above-mentioned dates; also the like dividends or interest which, although not entrusted to an agent in this country for payment, are realized in the United Kingdom between those dates through bankers, coupon dealers, or other persons.

(*c*) Interest and annuities paid between those dates by municipal corporations or other local authorities to creditors on rates, and not paid, or not wholly paid, out of profits and gains brought into charge to income-tax.

(*d*) Other interest and annuities paid between those dates, and not paid, or not wholly paid, out of profits and gains brought into charge to income-tax.

In cases falling within Class I.:

(i.) Where any annual payment is made in one sum, tax will be deductible at the rate of 3s. in the pound.

(ii.) Where the dividend, interest, or anunity is paid in two half-yearly sums of equal amount, and one such sum has been paid prior to the 6th of October, 1915, under deduction at the rate of 2s. 6d. in the pound, tax will be deductible from the subsequent half-yearly payment at the rate of 3s. 6d. in the pound.

(iii.) Where the dividend, interest, or annuity is paid in four quarterly sums of equal amount, and two such sums have been paid prior to the 6th of October, 1915, under deduction at the rate of 2s. 6d. in the pound, tax will be deductible from each of the two subsequent quarterly payments at the rate of 3s. 6d. in the pound.

(iv.) Where the dividend, interest, or annuity is paid at other intervals than half yearly or quarterly, or by payments unequal in amount, and one or more payments have been made after the 5th of April, 1915, and before the 6th of October, 1915, tax will be deductible from any further payment or payments at the rate of 3s. in the pound, and, in addition, such a sum will be deductible as is required to make up the difference between the total amount of the tax actually deducted from the previous payment or payments and the total amount that would have been deductible from such previous payment or payments if the rate of tax had been 3s. in the pound throughout the year commencing on the 6th of April, 1915. If at the time of the first payment subsequent to the 5th of October, 1915, the total amount of the dividend, interest, or annuity payable in the year ending the 5th of April, 1916, can be ascertained, the additional deduction in respect of the previous payment or payments should be apportioned equally between all the subsequent payments to be made during that year. Otherwise, the whole additional deduction should be made from the next payment subsequent to the 5th of October, 1915.

Class II.—Payments made after the 5th of October, 1915, out of profits or gains brought into charge to income-tax.

This class comprises:

(*a*) Ground rents, &c., secured on property charged with income-tax.

(*b*) Interest or annuities wholly payable out of property, profits, or gains charged with income-tax.

(*c*) Dividends paid out of the profits or gains of public com panies in the United Kingdom.

Tax is deductible from payments falling within this class at the rate or rates in force during the period through which the same were accruing due.

The adjustment of deductions from such payments is primarily a matter to be settled between the payer and the recipient, and does not immediately concern the revenue.

Under the provisions of the resolution, the general principle upon which the payer is entitled to deduct tax from annual sums of this class due or payable after the 5th of October, 1915, is that the total amount deducted on account of payments accruing in the year commencing the 6th of April, 1915, shall be at the rate of 3s. in the pound.

The following observations may be of assistance to those concerned in making or adjusting deductions from payments of this class.

(i.) Tax may be deducted at the rate of 3s. in the pound in respect of so much of any payment made after the 5th of October, 1915, as has accrued between the 6th of April, 1915, and the 5th of April, 1916, inclusive.

(ii.) Where before the 6th of October, 1915, tax has been deducted from a payment or payments accruing wholly or in part after the 5th of April, 1915, a further deduction, in addition to that mentioned in the preceding paragraph, may be made from the subsequent payment or payments accruing before the 6th of April, 1916, of such a sum as is required to make up the difference between the total amount of the tax actually deducted from so much of the previous payment or payments as accrued after the 5th of April, 1915, and the total amount of the tax that would have been deducted if the rate of tax had been 3s. in the pound throughout the year commencing the 6th of April, 1915. This further deduction should be made from the next payment made after the 5th of October, 1915, except in the case of two equal quarterly payments, when it should be divided.

BUILDING ECONOMIES AND GAS-FIRES.

The number of the "Builder" for the 24th ult. points out that "it has now become a recognized fact that modern gas-fires have immense possibilities as heating agents;" and our contemporary proceeds to give some notes on types of modern gas-fires and their "possibilities as regards present and future economy in building."

The article—after dealing with the question under the sub-headings of: Radiant heat, the hygienic aspect of modern gas heating, the old-age domestic problem, modern improvements, the architect and builder and the portable fire, the wastefulness of using two appliances for one purpose, the sentimental desire for the appearance of a coal-fire, coal-grates that rapidly fall into disuse, the architects' and builders' difficulty in the past, a wide choice of gas-grates now available—proceeds to point out that there are, of course, several economies possible in buildings where initial preparation is made for gas-fires. First, there is no need to set coal-grates in position, but tiled bricks or slabs may be fixed instead, leaving suitable openings against which the gas-grates or gas-interiors may be stood. Second, the size of the chimney flue could be materially reduced, as a gas-fire does not need—indeed, it works better without—such a large flue area as a coal-fire, because the quantity of products of combustion the chimney flue is required to deal with or remove is so very much less, and there is no soot deposited to reduce or partially obstruct the flue area. The largest gas-fire made does not need a chimney flue with an area of more than 36 square inches. The most suitable chimney flue for the flue outlets at present constructed to gas-fires is one of an oblong shape, say, 12-inch by 3-inch, or thereabouts. Third, owing to the smaller flue area required, if suitable flues were constructed when buildings are erected, there would be an increase of floor-space in every room, because the present depth and width of chimney breasts would be reduced. The heat would also thereby be more evenly distributed about the room, as the radiance from a coal or gas fire cannot penetrate into the fairly deep alcoves now made on either side of the chimney breast, owing to its projection into the room.

The concluding section of the article deals with "some recent interesting installations," concerning which our contemporary says: We know of one eminent architect who at his own residence, which was recently built, adopted the plan of having gas-fires fitted in marbled or tiled openings in every room except one, which has a coal-grate for sentimental and constant use. It is worth mentioning also that the members' bedrooms at St. Stephens' Club, which has recently been rebuilt, are all fitted with gas-grates set back to tiled openings; no coal-grates having been fixed.

The details of a unique gas-fire installation in an operating theatre that was recently built in an important private hospital in London should be of interest to our readers. In this case only a flat wall could be provided, and no chimney breast—any projections in such a room being, of course, as far as possible "taboo."

When consideration was being given to the problem of heating this operating theatre, it was decided that if gas could be applied in a suitable form it would fulfil all the requirements—viz., to provide a considerable amount of heat at a moment's notice and at an economical rate. No dust or dirt was to be emitted, and no attention or clearing-up was to be required. It was necessary that the heat, when it was no longer required, should be capable of being dispensed with as rapidly as it was generated. Of course, in this case a coal-fire or an ordinary portable gas-fire to stand in front of a grate would not have conformed to all the rules, and would not have been permissible; but the difficulty was got over by providing a shallow flue in the wall, and actually building into the wall a gas-grate consisting of little more than a copper band and a canopy, which are fixed back into the marbled wall, containing the burner, firebrick, and necessary fireclay uprights or radiants. The fire was a wide duplex one, and the knobs shown at the bottom take the place of the usual taps to control it—making it possible to use all the fire or only the centre, leaving the outside radiants out of use.

THE COAL BYE-PRODUCTS INDUSTRY.

A General Meeting of the South Wales Institute of Engineers was held at Swansea last Tuesday—under the presidency of Principal Griffiths, F.R.S.—when an interesting discussion took place on three papers, by Messrs. Butterfield, Watts, and Greaves, dealing with the utilization of bye-products of coal, which were read at the Cardiff Trade Extension Conference last April, as reported in the "Journal" at the time—see Vol. CXXX., pp. 205 to 212.

Mr. H. T. Wales, ex-President, referred to the dependence of this country upon Germany for many valuable bye-products, while all the time we had been producing vast supplies of the raw material, coal, which only required to be properly treated to give us all we needed of these important substances. Individual collieries—owing to difficult physical conditions underground—could only produce relatively small outputs of coal of a suitable kind for yielding bye-products; and this appeared to be a clear case where co-operation would be of great benefit. If a group of collieries joined together to erect bye-product recovery plant on a scale to ensure profitable working, there would be a considerable increase in the selling value of the output of each of the collieries so combined.

Mr. C. A. Seyler said the chief sinners in this matter were works proprietors and capitalists, in their lack of appreciation of scientific work. They had not enough imagination to spend money—as the Continental capitalist always did—where they could not see an immediate rofit; and the man who could not imagine a profit did not deserve it. he British scientist was every whit as able and as inventive as the erman; but he was not afforded the same opportunities. The result as that England was paying the penalty during this war.

The PRESIDENT agreed generally with Mr. Seyler's observations—dding that all their energies in South Wales seemed to have been evoted to getting coal rather than finding out how best to use it. The reatest advances in chemical discovery, he said, had not been made y Germans but by the English and the French.

Mr. T. G. WATTS, one of the authors of the papers under discussion, aid the great obstacle was to get works proprietors to understand the alue of the laboratory. There were very few industries in South Vales where any chemist was employed; and this only lately. They tarted the coke-oven industry in South Wales twenty years after ermany did so, and they were still twenty years behind the Germans n their output. There was more waste of coal going on in South Vales than most people were aware of.

Mr. R. H. GREAVES, another of the authors, said it could not be enied that, in the use of coke-oven gas for lighting purposes and for he production of electrical energy, Germany had enormously outaced England. In South Wales at present nothing had been done in his direction except at Bargoed, though it need not be feared that the ow volatile coals used for coking in South Wales would be unfit for he purpose. Belgian coals with 18 or 19 per cent. of volatile matter vere yielding 4000 cubic feet of gas per ton for town lighting, with a andle power of 560 B.Th.U. per cubic foot. The public would, of ourse, have to be guarded against any attempt to force-up the price f coke-oven gas in the event of the shutting-down of local gas-works. oke-oven owners, on the other hand, would have to consider the uestion of their responsibility to the public for a permanent supply, nvolving the maintenance of the working of the ovens regardless of he fluctuations of the coke market. There was no part of the United ingdom more fitted to test these things than South Wales.

The PRESIDENT complimented the authors upon the most useful nformation they had embodied in their papers, and the discussion as closed.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

At last Monday's meeting of the Edinburgh and Leith Gas Commisioners, the minutes presented by the Works Committee included an stimate of the revenue and expenditure of the Trust for 1915-16, by Mr. A. Canning Williams, the Treasurer and Collector. It was asumed that the sale of gas to private consumers and in bulk would be he same as for the year 1914-15; and that for public and stair lighting there would be a decrease in consumption of 50,455,950 cubic feet. The expenditure items amounted to a total of £380,955. Residuals vere expected to bring in £78,705 (as compared with £68,702 in 914-15); and rental of gas-fires and sundry items, £12,860. This left £289,390 to be raised from the sale of gas. By increasing the price 8d. er 1000 cubic feet to ordinary consumers and for gas consumed beond the municipal boundaries, and 6½d. per 1000 cubic feet to preayment consumers, it was anticipated a net revenue from gas of bout £291,520 would result, or £2130 more than the actual sum required to balance the estimated expenditure. This surplus, it was uggested, should be appropriated as a first instalment towards the £9320 which is due to the Special Reserve Fund.

The price of gas to prepayment consumers was proposed at 3s. 3d. per 1000 cubic feet—7d. beyond that charged to ordinary consumers. When it was decided to reduce the extra charge to these consumers from 1s. 1½d. to 7d. per 1000 cubic feet, the prepayment mechanism of the meters was not adjusted to give the increased quantity of gas for 1d.; but 6½d. per 1000 feet was returned to the consumers as a rebate. It was now suggested that this rebate should be discontinued. This concession of 1½d. per 1000 feet would amount to about £326 up to May 15 next; but the cost of altering the meters would be saved. The respective prices to ordinary and prepayment consumers would thus be 3s. 4d. and 3s. 9½d. per 1000 cubic feet. The Commissioners agreed to the additional charge without discussion.

In July last, Mr. Williams pointed out, it was resolved to act along with the Convention of Royal Burghs in applying to Government to suspend all sinking funds during the war. Action was duly taken. In his reply to the recommendations of the Annual Committee of the Convention, the Secretary for Scotland—while admitting that gas undertakings were placed in an exceptionally unfavourable position owing to the war, and that there might be some ground for their expecting a certain measure of relief after peace had been declared—said that he could hold out no hope that the proposal to suspend the sinking funds could be entertained.

The Aberdeen Gas-Works assessment case has now been for the time settled. It may be remembered that the Parish Council appealed against the following entries being made by the Assessor in the valuation roll for the gas-works:—

Gas-works buildings	£2,759
Apparatus	5,061
Machinery	637
Railway	107
Main and service pipes	3,002
Total	£11,566

The Parish Council craved that the valuation of the subjects should be entered in one sum, and increased to the amount of £20,226. The Lord Provost gave the decision of the Court as follows: The Magistrates having heard the arguments of the parties, and considered the case, are of opinion that the decision in the Arbroath case confirms the practice of arriving at the rent or annual value on the basis of the revenue of the preceding year, and accordingly sustain the entries made by the Assessor, and dismiss the complaint. The Agent for the Parish Council expressed dissatisfaction with the decision of the Magistrates, and asked for a case to be stated. This was agreed to.

On the 23rd ult., the Lanarkshire County Valuation Appeal Court held a special meeting to consider appeals by the Motherwell Town Council against the valuation of their Motherwell and Carfin Gas-Works. In the case of the Motherwell works, the valuation was reduced from £7693 to £5600; and in the case of the Carfin works from £1036 to £600. Mr. A. Mackay, the Gas Manager, conducted his own appeals; and, as the results show, he made out a splendid case for the reduction of the valuation.

A long discussion regarding the undelivered balances of coal contracts took place at last Tuesday's meeting of the Dundee Gas Committee. In answer to a question, the Convener stated that their stocks at present amounted to 15,000 or 16,000 tons—a very satisfactory stock. The Town Clerk reported an interview he had had with the coal merchants who had not completed their contracts. He said the merchants explained that their reason for not delivering the whole quantity contracted for was that the Gas Department did not take any portion of the coals contracted for in June until September. Between September and April, consequent on the war, their deliveries from the collieries were restricted. Mr. Yuill, the Gas Manager, had prepared a lengthy statement, in the course of which he said that the invariable practice in regard to balances had been to carry them forward for delivery during the ensuing months. This was the first instance of contractors refusing to deliver balances after the end of April. He had prepared a statement showing the deliveries of coal from May 1, 1913, with the balances standing at that date; and it would be seen that all had been delivered during the subsequent period until completion. There were also a number of balances of Broughty Ferry contracts—varying from 20 to 300 tons; and these were all delivered during the subsequent months. The total amount delivered was 2800 tons.

Yesterday week a special meeting of the Perth Town Council was held to receive the accounts of the Gas Department and to fix the rates for the current year. Ex-Bailie Wright, the Gas Convener, in the course of his statement, referred to the causes responsible for the decrease in the number of gas accounts, which was mainly brought about by the shortage of coal and the decreased value of bye-products. He moved that the rate be fixed at 3s. 6d. per 1000 cubic feet. Ex-Bailie MacPherson, who seconded, said he thought the extension of the gas scheme to Bridge of Earn, Almondbank, and Methven was a sound commercial transaction. The rate suggested was unanimously adopted.

At the last meeting of the Sanquhar Town Council, some discussion took place relative to the cost of running the gas-works and the price to be charged for gas. The Town Clerk explained that there was outstanding the sum of £544 of capital expenditure, and also a sum of £84 to the contractor for laying the new main. Authority for a loan of £700 was granted. The Town Clerk stated that the revenue from the gas-works for the year ended May 15 last was £1015. The expenses of running the works were £780; reduction of loan, £90; interest on loans, £241. This gave a loss of £7 on the year's working; and with the increase in the cost of labour, coals, and the extra interest on the proposed new loan, it would be necessary to increase the price of gas. It was stated that if an increase of 5d. were made, it would yield about £70, which might suffice. After discussion, it was decided to increase the price of gas accordingly—ordinary meters from 5s. to 5s. 5d. and prepayment meters 1d. for 14, instead of 15 cubic feet. Gas through prepayment meters will cost 5s. 10¼d. per 1000 cubic feet.

A Year's Gas Consumption in Leeds.

The annual report of the Leeds Corporation Gas Committee (issued last week) states that the gas made during the year ended June 30 was 2,970,185,227 cubic feet—an increase of 5·2 per cent. upon the previous year. The quantity of coal and cannel carbonized amounted to 260,482 tons, or an increase of 5·5 per cent. upon the previous year. The quantity of gas sold, including that used on the works, gasholder stations, &c., was 2,728,166,093 cubic feet, or an increase of 5·7 per cent. The revenue account shows a deficiency during the year of £32,982, against an estimated deficiency of £9170; the difference being due to the decrease in the price of residuals and the reduced consumption caused by the war. To this figure must be added the deficiency of £16,326 brought forward from the previous year.

Street Lighting at Bagshot.—A special meeting has been held by the Bagshot Urban District Council to consider the question of street lighting, consequent upon a communication from the Gas Company asking for an increase in their terms of contract. The Surveyor (Mr. W. D. Bell) reported that at the previous meeting the Council recommended all lamps should be fitted with incandescent burners, which he had ascertained would mean an increased cost of 3s. 6d. or 4s. per lamp. The Chairman (Mr. S. W. Evans) said he thought it unnecessary to have the incandescent burners during the war. After discussion, the Clerk was instructed to inform the Company that the Council could not agree to pay the extra 3s. per lamp demanded, but were prepared to renew the contract on the old terms. If the Company could not undertake this, the Council asked for an estimate for lighting a portion only of the lamps.

Sidmouth Gas-Works' Extensions.—At a meeting on Monday of last week of the Sidmouth Urban District Council, it was reported that a notification has been received from the Local Government Board that permission will only be given at present to borrow the sum of £1073, which has been expended on an extension of the gas-works; £569 of the £1130 expended on meters and cookers; £329 of the £500 expended on mains and services; and £136 of the £391 expended on pipes and fittings. The Gas Committee have written to the Board urging that the borrowing of the whole amount should be sanctioned, inasmuch as the expenditure proposed is necessary in order to provide a number of ratepayers with cheaper means of cooking than are provided by the ordinary coal-fire. The Chairman (Mr. J. G. H. Halse) thought the Council ought to do everything they could to bring pressure on the Local Government Board to sanction this work. It was not only for the immediate benefit of the whole community, but it would help to make the gas-works self-supporting.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Oct.* 4.

There are no new features in the tar products market. It is reported that during last week 26s. net at makers' works was again realized for pitch for export. Solvent naphtha is in good demand at from 2s. to 2s. 1d. net and naked at makers' works; while creosote is steady at 4½d. net in bulk. Creosote salts and naphthalene are almost unobtainable, and the values are very high.

Sulphate of ammonia is in increasing demand. Buyers are no doubt encouraged by the expectation of greater freedom in obtaining export licences than has recently been the case. Makers quote £14 7s. 6d. net and naked at producers' works for the 25 per cent. quality.

Tar Products in the Provinces.

Oct. 4.

There is practically no alteration in the markets for tar products. It is very difficult to do business in pitch, in spite of the willingness of manufacturers to accept reasonable prices. Creosote is still quiet, and difficult to sell. Solvent and heavy naphthas are in very good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 20s. 3d. to 24s. 3d. Pitch, East Coast, 21s. to 21s. 6d. per ton; Norfolk, Suffolk, and Humber ports, 19s. to 20s.; West Coast, 20s. to 21s. Manchester; 21s. to 21s. 6d. Liverpool; 21s. to 22s. Clyde. Benzol, 90 per cent., North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅞d. to 3d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 5d. to 3s. 6d. Naphthalene, £16 to £25; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Oct.* 2.

At the commencement of the week the tone continued dull, but by the middle of the week there was renewed activity in the market, and higher figures have been paid at all ports. New foreign business has not been large, but all available supplies have been keenly competed for by middlemen. The nearest prompt values are now £14 11s. 3d. per ton f.o.b. Hull, £14 13s. 9d. f.o.b. Liverpool, and £14 16s. 3d. f.o.b. Leith. The improvement has also been felt in the forward position, and producers report that they have realized £15 per ton f.o.b. Liverpool for October-March delivery in equal monthly quantities.

Nitrate of Soda.

The market for this material has advanced further, and spot quotations are now 13s. 6d. per cwt. for ordinary quality, and 14s. 6d. for refined.

Sulphate of Ammonia.

From another source it is stated that this market has been quiet throughout the past week, and there is practically no alteration in prices. Outside London, makes are quoted at £13 17s. 6d.; Hull, £14 7s. 6d.; Liverpool, £14 7s. 6d. to £14 10s.; Leith, £14 12s. 6d.; Middlesbrough, £14 7s. 6d. to £14 10s.

COAL TRADE REPORT.

Northern Coal Trade.

In the northern coal trade, the demand is steady, and prices on the whole are firm. But steamers are rather scarce, and this has its effect on the shipments. In the steam coal trade, best Northumbrians are from 18s. to 18s. 6d. per ton f.o.b.; second-class steams are about 16s. per ton; and steam smalls are from 11s. to 14s. per ton f.o.b., according to the class. In the last week or two, smalls appear to have been more abundant, and thus the values on the whole are a little easier. Work is rather more active at the collieries, and there is a steady output. The gas coal trade shows fuller activity; and the deliveries appear to be growing, both on the long home contracts and for export to some of the southern countries. Best Durham gas coals are from 19s. per ton f.o.b.; second-class qualities are about 16s. 6d. to 17s. per ton; and for "Wear Specials," the current quotation is from 20s. to 20s. 6d. per ton f.o.b. There has been some attempt at negotiation for forward supplies of coal for the Paris Gas Company, but high prices and freight have so far prevented any settlement. The freights in the open market for gas coal are based on about 9s. Tyne to London; but the rates for the steamers that were interned are a little lower. In the coke trade, production is slowly increasing, but is well taken up. For good gas coke, the price is steady at 28s. to 30s. per ton f.o.b. in the Tyne.

Price of Gas Increased at Rowley.—A notice has been issued by the Rowley and Blackheath Gas Company, announcing an increase in the price of gas of 3d. per 1000 cubic feet. The notice states that, when the Directors advanced the price at the end of the March quarter, they hoped this would be sufficient to meet the increased cost of coal and other materials; but the advance which has taken place in the price of all materials necessary for the manufacture and distribution of gas has been more than was expected.

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Machinery Depreciation and Income-Tax.

In the House of Commons on Tuesday last week, Mr. Nield asked the Chancellor of the Exchequer whether the allowance for depreciation on machinery under income-tax assessment will be increased, in view of the addition to the tax on the manufacturing community, among whom there is a consensus of opinion that the present 5 per cent. allowance is inadequate, in view of the rapidity with which modern machinery calls for replacement. In his reply, Mr. M'Kenna stated that the rates of allowance for depreciation upon machinery, even in trades where a standard rate has been fixed by agreement with representative trade associations, are not rigidly fixed, as suggested by the question. The Commissioners of Taxes are empowered to make such deduction as they may think just and reasonable according to the circumstances of each case.

* * *

An Interrupted Gas Supply.—A Reuter telegram from Amsterdam on Monday of last week stated that the "Telegraaf" learned from the frontier that on Sunday afternoon bombs were once more thrown on Bruges. At Sluis, which gets its gas supply from Bruges, a sudden fall was noticed in the gasholder at about two o'clock. The gas supply had ceased, and has not been restored up to now. It is surmised, though, of course, without certainty, that the gasholder at the Bruges works has been damaged.

Cirencester Gas Company, Limited.—The ordinary general meeting of this Company was held last Wednesday, when the accounts submitted showed that the profit for the year to June 30 was £3439; the sale of gas being more than 3 million cubic feet above that of the year ending June, 1914. The price of gas has recently been raised 5d. per 1000 cubic feet. The dividends agreed to made, with the interim amounts already paid, 11, 5½, and £7 14s. per cent. per annum on the several classes of shares. A further £200 was added to the contingency fund, making it £2232.

Mr. Webb, of Stourbridge, Annoyed.—At the Stourbridge Town Council meeting yesterday week, the Gas Committee reported that they had interviewed Mr. Councillor Keeble as to the grounds for his statement at the last meeting of the Town Council relative to alleged pressure put upon employees of the department with a view to their enlistment in His Majesty's forces. They recommended that the Town Council "express to the Manager of the Department their regret at the annoyance caused him by the accusations made, which on investigation proved to be without any foundation of fact." Mr. Keeble said, when he made his previous statement, he did so in good faith. He wished to express his regret to the Manager for any pain and annoyance that the word "coerce" had caused him; otherwise he stood by what he said previously. Several members of the Council criticized Mr. Keeble's conduct; and the Council adopted the recommendation with the addition of the words, "and regrets exceedingly that Councillor Keeble has not made a satisfactory apology to the Gas Manager for his charges."

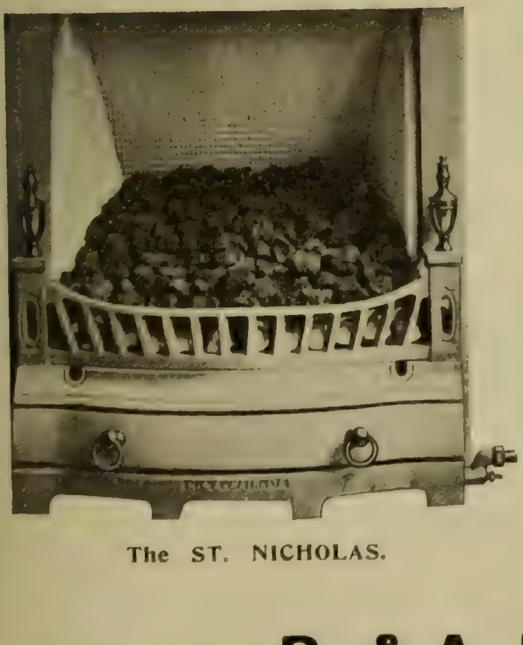
Gas and the War.

In a lecture to the Doncaster Tradesmen's Association, on the "Production and Uses of Gas" [which covered the complete ground of the origin and development of the gas industry the method of manufacture, the improvements effected in gas lighting, the remarkable development of gas for heating purposes, and its manifold applications to commercial and industrial work], Mr. Robert Watson, the Gas Engineer, threw some sidelights on the important part the gas industry is now playing in the production of munitions of war. Dealing with the bye products, he mentioned that benzene and toluene were the raw materials for the manufacture of explosives. The oils derived from tar contained picric acid, which was the basis of lyddite, melinite, and the Japanese explosive shemose powder. A product of recent times derived from gas was toluene, which was the base of "T.N.T.," the chief high explosive used in the present war. Practically all the gas producers in the country were engaged in supplying this important byeproduct to the Government; and while he could not say much publicly as to the methods employed, he could state that the Doncaster Gas Department had earned an appreciative letter from the Ministry of Munitions as to the results they had obtained. Touching on the important part played by gas bye-products in the dye industry, Mr. Watson observed that this industry was in the hands of the Germans; but we were now endeavouring to get it back in this country, and he believed we should succeed. Since the beginning of the war, gas had been found of increasing value in many phases of the manufacture of armaments; and enormous quantities were being used in munition areas. Gas-furnaces, large and small, were being employed in the heat treatment of shells. One furnace recently supplied to an armament firm held at one charge eleven of the largest naval armour-piercing shells, each shell weighing somewhere about a ton. In oven-furnaces of various kinds, brass cartridges and shell cases, revolver parts, army utensils, brass buttons, &c., were annealed. Gas blow-pipes were used for such purposes as welding handles on to bayonets, brazing, and repairs. A hearty vote of thanks was accorded the lecturer.

* * *

Increase of Price at Devonport.—The Plymouth Corporation Gas Committee have decided to increase the price of gas, from the meter readings for the Michaelmas quarter, by 3d. per 1000 cubic feet. This will make the cost to ordinary consumers 2s. 7d. per 1000 feet; the quantity supplied to slot consumers being reduced from 27 to 25 feet for 1d. The increase only applies to the Devonport area of the extended borough of Plymouth. In the area supplied by the Plymouth and Stonehouse Gas Company, the price is 2s. per 1000 cubic feet; and the Company recently announced that it will probably remain at this figure throughout the winter. For public lighting the discount of 5 per cent. is to be discontinued; and for power, 2s. 4d. per 1000 feet is to be charged. Mr. Isaac Carr, the Consulting Engineer to the Corporation, attended the meeting at which the advance was agreed to, and reported upon the working of the undertaking.

THE MAIN GAS FIRES.



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London Lighting Restrictions.

Additional stringent restrictions came into force in the London district on Friday last, which have had the effect of further reducing the light available for wayfarers after dark. It is ordered that public lights in streets and squares, on bridges, and in all other public places, must be so extinguished, reduced, shaded, or obscured as to break up all conspicuous groups and rows of lights and to produce as nearly as possible a uniform distribution of street lighting. Sky-signs, illuminated fascias, illuminated lettering, and outside lights of all descriptions used for advertising or for the illumination of shop-fronts, must be extinguished. The intensity of the inside lighting of shops and shop-fronts must be reduced so that no more than a subdued light is cast in any direction outside the premises. All sources of light must be so screened as to cut off all direct light from windows and doors. Bright lights in hotels, flats, dwelling-houses, &c., must be shaded or windows screened, so that no bright light is cast in any direction outside. All large lighted roof areas must be covered over or the lighting intensity reduced to a minimum. The lighting of railway stations, sidings, and goods yards must be reduced to the intensity sufficient for the safe conduct of business. The upper half of the globes of all bright lights must be shaded or painted over. Lights along any water-front must be masked to prevent as far as practicable the reflection of the light upon the water. The aggregation of flares in street markets is prohibited; but properly screened lights of moderate power may be used. In case of a sudden emergency, all instructions given by the Admiralty, as to the further reduction or extinction of lights, must be immediately obeyed. This order applies to the City of London and the whole of the Metropolitan Police District, from 6 p.m. till sunrise.

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Brighton (Victoria) Gas Company, Limited.—The half-yearly meeting of this Australian Company was held on Aug. 12. The report and balance-sheet showed that the profit for the half year to June was £4626; and after providing for fixed charges, there remained a balance of £3933, which, with the balance brought forward, made a total of £9354 available for distribution as follows: Dividend of 6 per cent., £1800; renewals account, £2100; balance carried forward, £5454. The sales of gas increased by 11·7 per cent. over those of the corresponding half of 1914. The number of consumers had increased from 3039 to 3384, and gas-stoves from 2196 to 2584.

Leamington Priors Gas Company.—At the annual meeting of the Leamington Priors Gas Company last Tuesday the Chairman (Dr. T. W. Thursfield), in proposing the adoption of the accounts, said the war had affected the whole range of the Company's operations, and precautionary measures were taken without loss of time. The reserve funds, which were invested in Consols, amounting to £8960, had been converted into war loan; and in addition the Company had invested a further £2000 in the new 4½ per cent. war loan. Dividends of £1, 14s., and 9s. 10d. on the "A," "B," and "C" shares respectively were declared. Mr. Thomas Berridge was re-elected a Director.

Bexhill Water and Gas Company.

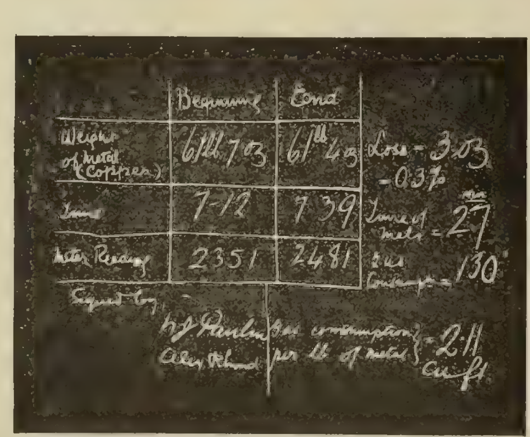
The half-yearly meeting of shareholders was held last Wednesday in London, Mr. Alex. H. Kersey in the chair. The accounts showed a balance available for dividend of £8013; and the Directors recommended £6 10s. per cent. per annum on the Company's capital of £34,000, authorized by their Acts of 1885 and 1892, and at the rate of £4 11s. per cent. per annum on the Company's capital of £123,710, authorized by their Act of 1896, Order of 1901, and Act of 1904, less income-tax. This, with due provision for income-tax, would absorb £3919, leaving £4094 to be carried forward to the next account. The revenue of the six months had amounted to £13,507, as compared with £12,732 in the corresponding period of 1914—being an increase of 6 per cent. The revenue from water had increased by £445, from gas by £348, giving a total increased revenue of £793. The expenditure had increased on water by £275, and on gas by £257—total, £532; while the general expenditure on water had increased by £85, and on gas by £48. The balance carried forward was greater than this time last year by £649. The increase shown in the Company's earnings by these figures, said the Chairman, told of the steady progress of the organization. But the increase in the expenses had also been very heavy, principally in coal, wages, and general outgoings. Yet these were not proportionately so great as in many similar undertakings. Under all the circumstances it was a matter for congratulation that they were able to pay the same dividend as last year; and it was the hope of the Board that they might have a similar pleasure in a year's time. With regard to the future—none of them could forecast the future of any industrial or commercial undertaking in the present terrible state of the world—it all depended upon the duration and result of hostilities. The Company so far had not been so seriously affected as was feared. Owing to the higher price of coal, &c., it had been decided to raise the price of gas 3d. per 1000 cubic feet as from the Michaelmas readings. The future prosperity of the Company was intimately bound up with the prosperity of Bexhill; and it was well for the future that there was not the smallest sign of depression in or around the town. It appeared to be eminently prosperous, and it had enjoyed an extremely good summer season, while the presence of troops, both in camp and billet, must be a financial benefit to the neighbourhood. In these most anxious times the Directors had given unflagging attention to the business; and the staff had worked with the most loyal and devoted self-sacrifice and energy.

◆

Fire at the York Gas-Works.—A fire last Sunday week, which originated at a tar plant erected close to the York Gas-Works, caused some amount of damage to apparatus used in the manufacture of gas, though fortunately not sufficient to necessitate the cutting off of the supply. A portion of an overhead railway siding was badly affected; and a meter-house and pump-house also suffered. Ample help was promptly forthcoming; and after about two hours' hard work, the efforts to overcome the fire were rewarded.

Wright's Crucible Melting Furnace.

At a Metal Melting Test made before the Newcastle and District Association of Foremen Engineers and Mechanical Draughtsmen, July 19th, 1915, 61 lbs. 7 oz. of COPPER was melted at the rate of 2·11 cubic feet of Gas per lb. of Metal Melted.



	Beginning	End	
Weight of metal (Copper)	61lb 7 oz	61lb 4 oz	Loss - 3 oz -·3%
Time	7·12	7·39	Time of melt = 27 min
Meter Reading	2351	2481	Gas Consumption = 130

Signed by

Gas consumption per lb of metal = 2·11 cu. ft.

Photo. of Blackboard, recording the Test.

N.B.

The metal melted was COPPER (not BRASS, which melts at a much lower temperature).

The test was no mere private laboratory trial, nor with a special apparatus.

It was a Public Demonstration made with ordinary apparatus.

No special contrivance for Gas-and-Air is required with this or any of our Furnaces.

JOHN WRIGHT & CO.,
Essex Works, BIRMINGHAM.

Municipal Water-Works Association.

At the annual meeting of the Association, which was held in London last Friday, Lieut.-Colonel R. S. Porter, J.P. (the Chairman of the Liverpool Water Committee), was elected President, and delivered an address, in the course of which he remarked that the fact that the terrible disasters which had overwhelmed civilization would have the effect very largely of curtailing domestic legislation—especially in the direction of the national conservation of the water supply of the three kingdoms—ought to strengthen the intention of the Association not only to safeguard mutual interests, but to endeavour to bring some harmony and concord where otherwise there would be dissensions and conflicting interests in the scramble for water sources. Referring to a proposal to enlarge the membership so as to embrace some of the smaller water authorities, he said the hanging-up of legislation would appear to indicate the desirability of the Association enlarging its sphere of influence. The Association should be a forum both for the concentration of effort where general unanimity prevailed, and for the removal or smoothing-down of difficulties where local interests might be thought to clash. One result which would flow from such a policy would be that the waste of ratepayers' money in Private Bill Legislation might be largely avoided. Still another matter for mutual usefulness and the safeguard of the ratepayers' purse was in connection with litigation. Having regard to the extraordinarily complex condition of water legislation, both local and general litigation must arise; but it did seem to be unfair that one unhappy water authority where some particular point had happened to crop up, should be called upon to fight perhaps a very important principle right through to the House of Lords, not only for their own benefit, but for the benefit of scores of other authorities. It ought to be possible so to arrange through the Association, when any legal dispute of a general nature arose, that some effort should be made to spread the expense over all those who were concerned in securing a satisfactory decision.

Irish Gas Prices.—The Navan (co. Meath) Gas Company have intimated an increase in the price of gas of 3d. per 1000 cubic feet. In Lurgan, the Gas Company announce that the price of gas for street-lamps this year will be 4s. 2d. per 1000 feet, *plus* the cost of upkeep, as compared with 3s. 10d. last year. The Council have decided to reduce the number of lamps in use, in order to economize.

Dorking Gas Company.—It was reported by the Directors at the half-yearly meeting of the Company that, after providing for interest on the debenture stock, there was a balance of £1989 available for distribution; and a dividend at the rate of 5 per cent. per annum on the various classes of shares was declared. After payment of this, there will be £739 to carry forward. The Chairman (Mr. H. Young) referred to the difficult period through which they had been passing, and expressed the regret of the Directors at having had to raise the price of gas last June.

Building Wrecked by a Gas Explosion.—A quantity of gas that had accumulated from an escape became ignited and exploded last Tuesday at Nos. 123 and 125, Newington Causeway, S.E., with disastrous results to property. An extensive building of three and five floors, 100 feet long and 30 feet wide, used as workrooms and stores by Messrs. Witsell and Co., was completely wrecked—all the windows being shattered and the contents hurled in every direction and smashed. Fortunately, no one was injured.

Rating of the Truro Gas-Works.—A recommendation by the Assessment Committee, that an expert surveyor should be engaged to value the property of the local Gas Company, has been referred back by the Truro Board of Guardians. The Chairman (Mr. W. C. Blamey) expressed the opinion that this was not the time to assess anything higher; and the matter should be arranged. This was also the view which had previously been put before one of the councillors by the Gas Manager (Mr. S. J. Ingram), who had pointed out that the calling-in of an expert would probably end in going to Quarter Sessions, and that it would be better for the Committee and the Company to agree. The Company were prepared to leave it to an umpire.

Stoppages of Gas Supply in Turkey.—The correspondent of the "Nieuws van den Dag" in the Turkish capital reports that scarcity is gradually beginning to be felt in almost everything; and the prescriptions and regulations interfering with the ordinary manner of living are becoming ever more severe and more numerous. Among other things he reports is that the three gas-works have had to come to a stop; so that there is no more street lighting. The electricity works will have to do the same during the present week; and then the trams will be unable to run. For days there has been not a drop of petroleum to be got in the city. Candles arrive now and again by parcel post from Austria, and then cost three piastres apiece—a price for which a whole packet could formerly be bought. The correspondent reflects: "How we shall warm ourselves in the winter if the present condition of things continues a few months longer, is still an unsolved riddle."

Electricity "Leakages" at Southend.—Commenting on the electricity charges in the borough, the "Southend-on-Sea Observer" says: A certain class of customers of the Corporation Electricity Department will have to pay more for electricity after the 24th inst. The reasons for the change, as put forward by the Chairman of the Committee at the recent Council meeting, are not very convincing in themselves. The Council were told that, though the meters had been gauged at a rate which made the price work out at 5d. per unit, as a mater of fact the net revenue had been 2·94d. per unit. Nothing was said to account for the disparity in the figures. The public ought to be told. Something like 2d. per unit seems to have gone astray somewhere. Presumably these twopences are keeping company with the more than half-a-million units which, according to the official statement for the year ended March, 1914, went astray during the twelve months (three times more than the quantity used for public lighting), or, in official parlance, are "not accounted for." Anyway, consumers of electricity with prepayment meters will have to pay 6d. per unit in future.

"R.H.D." Week.

OCTOBER 4th to 9th, 1915.

WE invite you to our London Showrooms to a SPECIAL DEMONSTRATION of the "R.H.D." (Radiant Heat Distributor) Gas-fire—one of the most important advances yet made in Gasfire construction. Booklet fully describing this new Fire will now have reached you.

Works:—
Academy Street,
Warrington.

THE RICHMOND
GAS STOVE & METER CO., Ltd.,
London Offices & Showrooms:
132, Queen Victoria Street, E.C.

Clay Cross Gas Prices.—The Clay Cross Gas Company have given notice of their intention to raise the price of gas by 3d. per 1000 cubic feet. This means that the price will be 4s. for lighting purposes and 3s. for power, heating, and cooking. The Company supply gas to Clay Cross, Tupton, North Wingfield, Pilsley, Stonebroom, Morton, and several other villages in the locality.

Lighting of Athy.—The Athy Urban District Council have declined to accept the Gas Company's tender for lighting. It appears that, owing to the increased cost of coal, the Company raised the price from 5s. to 5s. 5d. per 1000 cubic feet. Mr. Malone said the people did not object to the increase being made for public purposes; but they strongly objected to the raising of the price for private consumers to 6s. 3d.—a price the Company would not get if they went to Parliament to ask for it. It was stated that the lighting of the public lamps had not yet been commenced.

Reduced Lighting and Payment for Gas.—It has been reported to the Newmarket Urban District Council by the Sub-Committee appointed to interview the Directors of the Gas Company with regard to a reduction of the sum payable for public lighting under the existing contract, that the Directors could not see their way to increase the abatement of £100 offered for the past year. A list of replies received by the Clerk from the local authorities of the various towns in the Eastern Counties showed that very substantial allowances were being made in all the cases quoted. It was agreed that the matter be referred to the Town Committee for consideration.

War-Time Economies at Bury.—In accordance with a circular-letter received from the Local Government Board on the question of economy in municipal expenditure, a report on the subject is being prepared for the Parliamentary Committee at their next meeting. It is estimated that the total economies in the various departments will amount to between £4000 and £5000. The Street Lighting Department have reported that fewer men are engaged than in normal times, and that they are saving in gas and electricity about £30 per week. This is in addition to the saving of £750 per year effected by the adoption of incandescent lighting three years ago.

Launceston (Tasmania) Gas Company.—At the half-yearly meeting of this Company on Aug. 6 the accounts presented showed a satisfactory result of the work for the half year to June 30, notwithstanding the increased cost of coal, and the difficulty of obtaining supplies of the best quality. The number of consumers showed an appreciable increase. An interim dividend was paid in February; and the Directors recommended that a dividend at the rate of 4 per cent. for the half year be declared. The coal carbonized during the six months was 2019 tons, and the gas manufactured 22,656,200 cubic feet. The Chairman (Mr. H. Weedon), in moving the adoption of the report and accounts, hoped that things would soon settle down and that they would be able to return to their normal state. The affairs of the Company had been well looked after by the Manager (Mr. Arthur Green) and his staff.

Southport and the Hire of Gas-Fires.—The Southport Gas Committee have decided for the present to stop letting out gas-fires on hire. This decision has been come to with the object of keeping down capital expenditure as much as possible during the war. The local ironmongers are taking advantage of it to push the sale of gas-fires, both for cash and on the hire-purchase system.

Burnley Water Supply.—The Local Government Board recently refused, owing to the war, an application for further borrowing powers by the Burnley Corporation, to enable them to complete the new reservoir at Hurstwood. Some time ago, the Board sent down an Inspector to examine the works, with the result that they decided to sanction only the raising by the Corporation of £75,000 [which is the balance of £215,000 originally authorized to be borrowed], so as to enable the works to be brought to a stage at which they could be safely left until the war was over. As the £75,000 will be exhausted this winter, the Corporation have decided to promote a Bill next session to secure further borrowing powers.

Fortunate Coal Contracts at Neath.—That the Corporation have been exceedingly fortunate in their coal contracts for gas purposes was the gratifying statement made by Alderman Hopkin Morgan, J.P., at a special meeting of the Neath Town Council. He added that, if the tenders of last June had been then accepted, the Corporation would have been the losers by thousands of pounds. Wisely, they had proceeded from hand-to-mouth, so to speak, until the favourable moment arrived. Then the contracts were made—practically sufficient for the whole of the winter. The Council, he went on, were conversant with the fact that there had been many complaints with reference to the insufficient supply of gas. This was no new thing. Owing to the abnormal growth of the town in recent years, the mains were too small to meet the demands. The Gas Committee, therefore, asked the Council to sanction a loan of £1000 for the laying of new mains, which were absolutely necessary in the circumstances. This the Council agreed to.

The New Offices of the Metropolitan Water Board.—Referring to the Board's new offices under construction in Rosebery Avenue, the "Builder" last week said: It is not often that a change of contractors takes place during the progress of an important building contract, but the Metropolitan Water Board's General Purposes Committee are recommending this step to the Board. It is proposed that Messrs. Rice and Sons should take up the contract, which they are prepared to do subject to a sum not exceeding £4132 being added to the existing contract of £110,004, to meet the cost of certain items in the original bills of quantities which would now be unremunerative on account of the changed conditions prevailing. The contract figure will still be below that of the second lowest tender, which was that of Mr. J. Carmichael for £116,082, and below Messrs. Rice's competitive tender of £117,650. The Board may be congratulated on obtaining the services of one of the best building firms in London, which should ensure the successful completion of the new offices.

Radiant Efficiency

The Davis 1915 Intense-flame Gas-Fire Burner.

In addition to providing (by the co-operative adjustments of its Silent Injector and Pressure Damper) a range of efficient flames of adjustable intensity, the new Davis Intense-flame Burner also shows a marked improvement in Radiant Efficiency.

A smaller Fire is thus made to suffice for any given heating purpose, and a substantially higher percentage of radiant heat is returned from the gas consumed. *This we guarantee.*

The Davis Gas Stove Co., Ltd., *Gas Exhibition Salons:* **60, Oxford St., London, W.**

Belfast Electricity Supply Station.—Alderman Tyrell (Chairman f the Belfast Electricity Committee) announced at the Corporation meeting last Friday that an application had been made to the Board f Trade to hold an inquiry into the circumstances connected with a ecent fire in the electric station and an accident to one of the turbo-lternators [see "Journal" Sept. 7, p. 537], matters which had been he subject of much complaint and suspicion. The Board had, however, ntimated that jurisdiction was not vested in that Department, but in he Home Office, with whom communication had now been opened.

Metropolitan Water Board Money Bills.—At the last meeting f the Board the Finance Committee reported that in July the Board uthorized them to take the necessary steps for the issue of money bills to an amount not exceeding £1,350,000, in replacement of money bills amounting to £1,000,000 due on Sept. 18, and to meet further capital expenditure. Under their Act of this year, the Board were uthorized to issue bills to an amount of £2,000,000; and the Treasury sanctioned the issue of £1,300,000. Tenders for this sum were opened at the Bank of England on Monday last week. On the advice of the Bank of England the bills were for a currency of six months. The total amount applied for was £3,755,500—the highest price being £97 12s. Tenders at £97 10s. 10¼d. received 12 per cent., those above his price being allotted in full. The average rate obtained for the ssue was £4 17s. 9 7d.—equivalent to a rate of interest of £5 0s. 3·04d. per cent. per annum.

New Filtration Works at Morley.—The Morley Corporation are to be congratulated upon the completion of a long cherished scheme—the establishing of a new system of filtration in connection with their water-works at Withens, Cragg Vale, near Mytholmroyd. Some two years ago, it was decided to transfer the whole of the filtration to Cragg Vale, alongside the reservoir, put down a new plant, and scrap the existing systems. It was decided to accept the contract of the Turn-Over Filter Company, of Belfast; the estimated cost of the whole scheme being put down as £12,000. A fine new stone building has been erected on the hillside at Cragg, just below the reservoir, and here eleven cylinder filters have been put down, each with a filtering capacity of 8000 gallons per hour. The power required for the cleansing of the quartz in the cylinder is obtained from a petrol-driven engine. The water used for washing purposes is afterwards treated in a sedimentation tank, and then passed down the valley for compensation water. This is an important asset in the new scheme. In addition to the quartz, the filtration is carried out by means of allumino-ferric and lime water; the mixing of these chemicals being carried out by finely-balanced and self-acting machinery installed further up the hillside. Apart from the petrol engines, everything is so planned that it works by gravitation. In fact, economy and simplicity of working are features of the new plant. Though it is proposed to keep all eleven filters working, they are disconnected, and may be dealt with individually. This is the first plant of its kind in operation in connection with domestic water-works, and a good deal of interest is being taken in the experiment throughout the country.

The members of the profit-sharing and saving scheme in connection with the Gloucester Gas Company have made a donation to the British Red Cross Society of over £30.

The Coventry City Council are recommended to suspend, during the period of the war, the test for the illuminating power of the gas, and to substitute a test for calorific power. This is consequent upon a reduction in the illuminating power due to the extraction from the gas of toluol and benzol for Government purposes.

The Cleckheaton Gas Committee are preparing their old works at Marsh for restarting, in view of winter needs—the new works being regarded as scarcely able to meet all requirements. On Sunday afternoon, at the old works, a fire broke out in the engine-house, but was taken in hand and eventually overcome by the work's foreman and a number of men from a neighbouring factory.

An inquest was held at Plymouth last Tuesday on the body of Private Chegwin, aged 19, of the Royal Army Medical Corps, who was employed as orderly at one of the military hospitals in the town. The evidence showed that he was found dead from poisoning by gas fumes in a bath supplied with hot water from a geyser, which had been fitted about three months ago. Captain Taylor, who superintended the fixing of the bath, said the geyser was in a compartment divided by a partition from the bath-room, and had a flue for the conveyance of the products of combustion to the outer air. The fumes must have been driven into the bath-room by back-draught along the flue. A verdict of "Accidental death" was returned.

"Main Reflections" is the title of a new booklet [in a coloured wrapper, depicting a Red Cross Nurse enjoying a "St. Nicholas" fire], which is being issued by Messrs. R. & A. Main, Limited, of Edmonton. Four series of heaters—the "D.S.O.," "the St. Nicholas," the "Fire King" and the "Queen" fires, and the "St. Magnus" steam-radiators—are illustrated and described; and these, it is claimed, cover all that is up-to-date and efficient in modern gas-fire construction. The "Fire King" and "Queen" series is a new departure, introduced specially to fill the gap between so-called inset fires and the ordinary type of outstanding gas-fires. They are self-contained in every respect, and may be fitted anywhere in conjunction with a flue outlet; but they are designed to co-ordinate in size with any modern interior grate, so that when fitted against it "they give a sense and appearance of unison, not of discord." They are handsome in appearance, and embrace all the advantages of the "St. Nicholas" and "D.S.O." fires.

APPLICATIONS FOR LETTERS PATENT.

13,487.—Grafton, W., "Controllers for gas-fires." Sept. 22.

13,595.—South Metropolitan Gas Company and Chandler, D., "Gas-burners." Sept. 24.

13,663.—Tilley, F. C., "Burners." Sept. 25.

A CENTRAL RADIANT HEAT DISTRIBUTOR

Specially designed for the efficient heating of Hospital Wards, Factories, Workshops, Libraries, &c.

PARKINSON'S
"COMPASS" GAS FIRE

The heat is evenly distributed in all directions, while the duplex burner allows either half of the fire to be alight as desired.

Diam. of Fire, 8½-in. - Price £3 0 0
(Equivalent to a 21-in. fire) (Stone Slab and Guard extra).

THE PARKINSON STOVE CO., LTD.,
BIRMINGHAM and LONDON.

GAS COMPANIES IN THE STOCK EXCHANGE.

Business on the Stock Exchange last week was moved by conflicting factors. The favouring agency lay in the satisfactory despatches from several seats of war—the strong advance of the Allies on the Western front, the Russian recovery on the Eastern, and the important defeat of the Turks on the Tigris. These gratifying incidents inspired a tone of cheerfulness which became more and more pronounced from day to day. A conspicuous indication of this feeling was apparent in the gilt-edged market, where the war loan steadily rose, and buyers were many and sellers few. Colonial issues were in good demand, Home Rails brightened up, South Africans were buoyant, the Foreign Market recovered, and Shipping and the Miscellaneous lines which profit by the war had a good time. But the week did not close without a disagreeable check, produced by the Bulgarian intrigue; and the seriousness of the situation was reflected in Capel Court on Saturday. The successful conclusion of negotiations for the American loan excited keen interest, not unmingled with some soreness on the part of British investors at the handsome terms secured by Uncle Sam. They are pretty steep; but it is a great thing to have got the matter through at all. Business in the Gas Market was better. It was more active, and the prices marked for several issues were on the up-grade. A noteworthy incident was furnished by Alliance and Dublin, which (thanks to the greatly improved position and prospects of the undertaking) achieved the unprecedented distinction of changing hands at a price actually higher than the quotation of July 30, 1914, before the war. The Money Market was firmer in response to a good demand.

Bargains done for cash during the week were as follows: On Monday, Bournemouth debenture 80, 80½, Gas Light ordinary 77½, 77¾, 78½. On Tuesday, Commercial 4 per cent. 84, European 12½, Gas Light ordinary 77½, 77¾, 78, 78½, ditto preference 72⅝, 72¾, 72⅞, 73, ditto debenture 62½, 63, San Paulo preference 8⅝, 8¾, South Metropolitan 76½, 77¼, South Suburban 88½, 89. On Wednesday, Gas Light ordinary 77¾, ditto preference 73, 73¼, South Metropolitan 77, 77¼. On Thursday, Brentford debenture 75, Gas Light ordinary 77¾, 78¼, Imperial Continental 60, 60½, Primitiva 2, ditto preference 3⁵⁄₁₆, 3⅜, South Metropolitan 77¼. On Friday, Brentford debenture 75½, Gas Light ordinary 77¾, Imperial Continental 60¾, 62, South Metropolitan 76¾, 77¼, Watford "B" 106. On Saturday, Alliance and Dublin 68⅜, Gas Light ordinary 77¾, 78⅛, ditto maximum 60, 60½, Imperial Continental 63, 63½, South Metropolitan 76¾, 77¼.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING OCT. 2.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59—64	3 18 2	68⅜
374,000	"	July 10	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	16	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
373,480	10	"	7	B 7 p.c.	15—15½	4 10 4	..
95,000	10	"	6	Pref. 6 p.c.	13½—14	4 5 9	..
—	—	—	—	Deb.	..	—	80—80½
380,000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	5 5 3	..
330,000	"	"	11	Do. New	204—209	5 5 3	..
50,000	"	"	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	"	June 11	4	Do. 4 p.c. Deb.	91—93	4 6 0	75—75½
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	5 1 2	84
560,000	"	"	5⅛	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	"	June 11	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	"	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	"	"	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
—	—	—	—	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	"	—	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	European, Ltd.	17½—18	5 11 1	12½
16,362,910	Stk.	Feb. 12	4/17/4	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	77½—78½
2,600,000	"	"	3½	3½ p.c. max.	76—79	4 8 7	60—60½
4,062,235	"	"	4	4 p.c. Con. Pref.	96—99	4 0 10	72⅝—73¼
4,674,850	"	June 11	3	3 p.c. Con. Deb.	72½—74½	4 0 6	62½—63
130,000	"	"	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
—	—	—	—	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞†	Ilford A and C	151—154	5 2 4	..
65,780	"	"	6⅜†	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	Do. 4 p.c. Deb.	92—94	4 5 1	.
4,940,000	Stk.	May 14	9	Imperial Continental	150—160	5 12 6	60 -63½
1,235,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7	B	146—14	4 14 7	
306,083	"	June 26	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
75,000	5	June 11	6	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	Ottoman, Ltd.	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	Portsea, Island B	128—131	4 19 8	..
100,000	50	"	12	Do. C	118—121	4 19 2	..
52,000	50	"	10	Do. D	..	—	..
249,980	5	April 29	8	Primitiva Ord.	5½—6	6 18 4	2
499,960	5	June 26	5	" 5 p.c. Pref.	4¾—5	5 0 0	3⁵⁄₁₆—
521,600	100	June 2	4	" 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	" " " 1911	..	—	..
346,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	San Paulo 6 p.c. Pref.	10½—11	5 9 1	8⅝—
125,000	50	July 1	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	Sheffield A	223—224	4 9 8	..
209,984	"	"	10	Do. B	222—224	4 9 8	..
523,500	"	"	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	South Met., 4 p.c. Ord.	111—113	4 16 8	76½—
1,895,445	"	July 10	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	88½—
60,000	"	"	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
—	—	—	—	Do. West Kent.	..	—	..
137,058	"	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½†	Tottenham District A 5 p.c.	135—138	5 8 8	..
742,275	"	"	6†	B 3½ p.c.	115—117	5 2 7	102 -
181,255	"	June 26	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	5 5 8	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
				Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅜	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/3	" C 3½ p.c.	110—115	5 2 0	..
352,000	"	"	6⅛	Wimbledon 5 p.c.	117—122	5 0 5	104½—
98,000	"	"	6⅝	Epsom 5 p.c.	121—126	5 5 2	..
88,416	"	June 26	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

* Ex Div.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Superintendent. Sheffield Gaslight Company. Applications by Oct. 13.

Assistant-Engineer. Sheffield Water Department. Applications by Oct. 22.

Working Foreman. Abertillery Gas Department.

Appointments Wanted.

Representative. No. 6102.

Responsible Position in Gas Undertaking or Gas Manufacturing Firm. No. 6103.

Meeting.

Danish Gas Company. Millbank House, Westminster. Oct. 28. 2.30 o'clock.

TENDERS FOR

Coal.

Limerick Gas Department. Tenders by Oct. 11.

Fire Clay Goods.

Salford Gas Department.

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EDITORIAL NOTES.

The American Gas Congress.

GRADUALLY we are obtaining the information which enables us to piece together, and form some intelligent appreciation as to the character of, the proceedings at the International Gas Congress at San Francisco, in connection with the Panama-Pacific Exposition. And we hope before long, hrough special descriptive articles, to bring our readers into closer touch, so far as it be possible, with the enthusiastic pirit which, there is no doubt, was a dominating feature. So far, we have given several abstracts of the papers preented on the occasion; and to-day we have the pleasure of publishing the addresses of the President of the Congress Dr. Alexander C. Humphreys) and of the President of the American Gas Institute (Mr. E. C. Jones, of San Francisco). Dr. Humphreys was in the position of honour by right, as the recognized leader among American gas technicians. The gathering was international; but in representative *personnel* it was not completely so, owing to what the President described as the most "shockingly destructive and "horrifying war within the knowledge of man." However, as we have already seen, though the British gas profession was unrepresented in person, it was by papers.

Many sentiments—sympathetic and humane—fell, as would be expected by those who know him and his personal attributes, from the lips of Dr. Humphreys during his references to the events which have such current absorbing nfluence upon the mind of the whole world. We may reterate whole-heartedly his hope that out of the sanguinary conflict there may finally issue some measure of compensating good for the peoples as a whole, and particularly greater security for those who are anxious to live at peace with their neighbours, and to exercise the right of working out their own destinies free from outside pressure and interference. We know that those in America of English tongue, and those of the tongues of our Allies, are full of belief in the righteousness of our cause; and although Dr. Humphreys' words were tactful, speaking in a land embracing the extremes of a composite population, the direction n which his personal sympathies lie is plain and gratifying. He recognized that, though the American nation is not immediately participating in the great conflict, it is involved in it through the ties of brotherhood. However, although America is not actually taking part, it is, we are pleased to know and gratefully acknowledge, doing much in the cause of relief for those who have been rendered destitute by the destruction of their homes and the over-running of their lands by the aggressors in this great conflict. It is also helping in the provision (as a matter of business) of financial loans; and its factories are busy making munitions of war for the Allies. But America is looking beyond the present. It is easy to see that the country will be a large beneficiary through the war. There is no blame attaching to America for this. The greater part of its enormous population would rather there had been no war, than that their country should benefit considerably from the appalling destruction. It is a duty that America, from its independent position, owes to itself and to the part of the world that must draw on its productive resources, that these resources should be developed to the utmost, or, at any rate, to the ultimate boundaries of need. Dr. Humphreys sees the belligerent nations incapable for years to come of fully meeting their own requirements in many directions; and therefore he looks upon it—in no mercenary spirit, but as a responsibility—that America should prepare itself to meet the demands that will be made upon it. In this preparation, the engineering profession will share, through its duty to work for the realization of greater efficiency in the operations of the several industries concerned, so that advantage may accrue not only to these industries, but to the countries which will be the purchasers. This was all happily put by Dr. Humphreys; and his words should find good ground not only among the manufacturers of America, but among those of this country who are at liberty to develop their concerns.

In the work of the present, and in that lying before, the gas industry must have a large part, as the suppliers of light, heat, and power. All three are essentials in practically every industry; and the cheapness of the agent supplying all three purposes is of the greatest moment. An agent so essential should have the fullest liberty to develop its service on the most economic lines; but, in the very land that boasts of its liberties, there has grown up a system of regulation by Commission of public utility companies—gas undertakings among them—which tends to cripple, rather than to foster, economic progress, and attempts are still being made to enlarge the powers of the Commissions. The responsible men directing the gas industry of America could do more to promote its service to the community and industries if there were not this throttling of their best endeavours. We can sympathize with them; for the British gas industry has had an experience of legislative trammels which have impeded advancement, but from which there has been of late years some relief, which enables greater freedom in the adoption and utilization of processes at the manufacturing end, with the result that more suitable gas and more B.Th.U. can be supplied for a given price than would have been the case if the Legislature had not been persuaded that over-rich gas was not necessarily the best for use in bunsen burners, and that the really intrinsically rich gas was that which gave the best results in use. Regulation up to a point is good; but it is a pity when regulation is carried to the length that it robs an industry of some of its potentiality in service efficiency. When this is the case, then regulation defeats its own true ends. The American gas industry, like the British gas industry, is confronted by strong electrical competition, guided by men of the highest attainments; and the industry cannot therefore afford to neglect opportunities for betterment through processes and development of its service. Without regulation, competition would keep the gas industry in the way it should go; for if it departed from the way that best suited its customers, the policy would be suicidal, and the end a certainty.

But in America, despite regulation, despite competition, the gas industry is not anticipating being deprived of any one branch of its business. We see this reflected in the confidence as to the future as expressed in the address of the President of the American Gas Institute. Mr. Jones said: "The future of the gas business looks very bright. We are "the purveyors of a commodity which has become a public "necessity, and before us lies a field of opportunities. We "are dealing with British thermal units; and with a know-"ledge of their application, gas should be pre-eminent where "heat, power, or illumination is needed in domestic and "industrial economy." This in America, with cheap electrical units! Mr. Jones also spoke of the unshaken belief of the gas men of America in the efficiency and economy of gas for all purposes being necessary in the permanent development of business. There are no doubts or fears there as to development of the gas industry not proceeding on all current lines of trading; and no suggestion has been made that it would be as well to define the respective territories of the gas and electrical industries, and let each industry work out its own salvation within that territory. There is among our American friends a robust faith in gas as an agent for illumination as well as for those purposes in which electrical competition is of a weakly order; and there is no talk among them of doing ought else than use every effort to develop all lines of business, and not to relinquish anything without a struggle.

There is one other matter in Dr. Humphreys' address of which members of our own Institutions and Associations might well take heed. It is the point that he makes as to the responsibility of men who take part in discussions at technical meetings. He is convinced that the responsibility is not sufficiently recognized. Speakers appear to forget that the audience before whom they are speaking is numerically small compared with the subsequent world-wide readers of their remarks, who will be making judgment of the man who made them, and of his information on the subject, through the published reports in the technical papers. Discussions are often inadequate; the remarks of the speakers are frequently irrelevant, misleading, and futile; they may be complimentary, but they do not subscribe to knowledge. In discussions what is wanted is that more men should rise to their feet who can contribute something of value; and the windbags should recognize their own character and deficiencies, and appreciate that, in these times of requisite higher economy and greater efficiency, they would be contributing more value to the discussions by suppressing their own verbosity and remaining silent. In discussions, as in all else, let us be, as Dr. Humphreys exhorts, diligent and painstaking. Then the technical proceedings of our organizations will be of greater worth; and through them there will be developed "the truth, the whole "truth, and nothing but the truth." This is what should be the objective, and its attainment will make for progress, and that more rapidly.

A Last Message.

There is always something that stirs up one's inmost feelings on reading his last writings after a man has passed direct from active life into the great unknown. It is so in the case of the preface that Mr. Edward Allen, just before his death, penned to the British contribution to the proceedings of the great Gas Congress which has been held at San Francisco—describing gas practices on this side. We publish the preface in another column. The words and the turn of every phrase speak of Mr. Allen. The courteous apology for inability to redeem the promise made to visit San Francisco for the Congress, the hope that the proceedings at the Congress would reach the highest level of expectation, the note of respect and admiration for the American Gas Institute, the acknowledgment of the indebtedness of the gas industry universally to American gas engineers for their contributions to its advancement, while at the same time not overlooking the British title to recognition for what the home gas profession has done in the same direction—Mr. Allen's hand is in it all. Throughout the preface there is the recognition of universal co-operation in the technical work of the gas industry; and this is to the good and prosperity of the gas industry throughout the world. Nothing could have been better phrased as a last message to American *confrères* by the representative of the British gas profession who contemplated the long journey to San Francisco (but was called upon to take another and final one) than this passage: "The bond of friendship and good-"will that unites the gas industries of this country and your "great Continent is growing stronger year by year and "shares a part in the union between our countries that is "highly valued and appreciated at the present time, and "that shall never be broken." The members of the American and British gas professions will be at one in endorsing these words.

Value from Waste.

There are very good grounds for hope that the address of Professor William A. Bone, D.Sc., F.R.S., to Section B (Chemistry) of the British Association will result in a movement with the view of urging upon the attention of the Government the need, in the economic interests of the country, of doing something to stem the waste of coal and its valuable components that is rife both in industry and in the household. It is very desirable that the Council of the British Association should set up a Committee to consider the matter. If this is done, an important initial step will have been taken towards focussing public and scientific opinion on the question, and of, in the near future, making very strong representation to the Government. The idea of appointing such a Committee was influentially supported at the Manchester meeting of the Association. This is satisfactory; and we hope the result will be even more so.

One of the illustrations with which Professor Bone emphasized the waste of coal that is proceeding was provided by the beehive coke-oven, which stands as perhaps one of the most hideous of monuments to the slackness in some quarters of individual effort in the promotion of economy. Proving the slackness and waste of the one type of plant are the results from the other type—the bye-product coke-oven; and yet the owners of the beehive ovens calmly continue to operate their old plant while fully aware that savings in expenditure and considerably larger profits are to be realized by turning from the older to the newer order of operation. The "Iron and Coal Trades Review" estimates that, if the 6,600,000 tons of coal carbonized in beehive ovens were treated in bye-product ovens, 4,700,000 tons of coal would amply suffice to produce the same quantity of coke, which means a saving of about 2 million tons of coal. If, too, the 4,700,000 tons were carbonized in bye-product coke-ovens, there would be an additional supply of 188,000 tons of tar, 58,700 tons of sulphate of ammonia, 11,750,000 gallons of crude benzol, and 23,500 million cubic feet of gas. Certain of the computations may err somewhat on the high side. For instance, from 13½ million tons of coal carbonized in bye-product ovens in 1913, Professor Bone pointed out, the yield of ammonium sulphate was 133,816 tons—equivalent to an average of 22·4 lbs. per ton of coal, while the "Review" has evidently taken an all-round production of 28 lbs. per ton. The calculations of our contemporary are made on the best standards of working, but are near enough to impress the point it desired to make. Of course, change from beehive to bye-product working is not, commercially regarded, to the advantage of the gas industry, whose interests would lie in the direction of curtailing the supply of the products from coking plants, and of seeing these worked in the most wasteful manner. But the gas industry has never adopted such a foolish attitude as to object to other industries doing what it is continually striving to do itself—attain to greater economy in working, and therefore to greater profit from every ton of coal carbonized, to the advantage both of itself and its gas consumers. To object would be not only futile, but would suggest a disordered mind.

However, the perusal of our contemporaries devoted to colliery interests shows that here and there men are directing the attention of the owners of coking plants to the waste that is proceeding. That all the bye-product coke plants are not working up to the highest standards achieved by some (as is shown by the fact that the yields are not consistently on the scale of the ones which served the "Review" as a basis for calculation) is confirmation of the point made by Professor Bone in his address, that there is deficiency in connection with some plants of efficient chemical control and supervision, and upkeep. There are losses in heat, gas, tar, and ammonia, and an indifference to the conditions approved by skilled men for obtaining the highest yields of bye-products having regard to the realization of a good quality coke. The fact is that bye-product working, which is excellent in some places, wants thoroughly overhauling in others. If there is going to be any closer business connection with the gas industry, in supplying gas for town purposes, it would most probably be a good thing to study the question of the temperatures at which coking proceeds in relation to gas quality, and tar, benzol, and ammonia yields, and to see what would be the verdict of the balance-sheet, though it might reduce the coke-producing capacity of the ovens somewhat, to come down to the most suitable temperature for the gas and other secondary products. But diminished wear and tear on the ovens, the utilization of low-grade material in the producers (with bye-product recovery) for obtaining gas for heating the ovens, and the additional revenue from the higher yields of bye-products from the ovens, might make the balance-sheet very tempting. But this all asks for some proper chemical control and supervision.

The charge of want of economy in the coking and mining industries is very freely expressed in the coal journals as well as in papers read before the technical societies; and it seems that the suppression of this condition requires some strong action from without to supplement the spasmodic and not very effectual efforts from within. We have referred to the utilization, for the heating of coke-ovens, of producer gas made from inferior coal, with bye-product recovery, as one direction in which there is possible economy. This was one of the features of Mr. W. Chaney's paper before the Institution of Gas Engineers in 1913, describing the coke-oven installation at the Saltley Gas-Works at Birmingham. The subject was specifically dealt with by Mr. M. H. Mills, in a paper read before the Institution of Mining Engineers at Leeds [see "Journal," Sept. 21, p. 640]. Now that gas-producers have been developed to such a state of efficient working that good types can be obtained to gasify almost any class of fuel—even fuel containing as much as 50 per cent. of sh, which, under ordinary conditions of combustion, would go to form clinker—a new field of economy is presented. As Mr. Mills points out, a large quantity of low-grade fuel is now lost. In many cases where the coal at the top and bottom of seams is inferior in quality, it is left in the mine; but if this can be gasified, as well as other material that is ent to the tips, and the gas be used for heating and power purposes, then there is waste in rejecting it. Of course, it costs as much to raise inferior coal as good coal; and the coalowner, looking for the largest possible profits, prefers o send up from his pits the best saleable sort. Mr. Mills, however, argues that every ton of the hitherto unsaleable oal gasified in producers means a saving of ½ ton of good oal. It is not right, in the interests of the country and the uture, that mines should be operated in a wasteful manner as though there was no end to our mineral wealth and reources.

In addition to the heating of coke-ovens, there is a large field for producer gas in industries where heat and power are required on a scale that cannot be economically dealt with by the gas industry. To get our largest manufacturers, however, into the gaseous fuel vogue through producer gas must operate to the advantage of gas undertakings in those urban industries where heat and power on a smaller scale are required. Mr. Mills referred to the use of producer gas n the steel industry; but, as pointed out in Professor Bone's address, it has been demonstrated as possible to produce finished steel sections (rails, plates, girders, &c.), from a low grade iron ore, such as the Cleveland ore, with no further expenditure of coal than that which must be charged into a bye-product coke-oven to produce the coke required by he blast-furnace. Not another ounce of fuel of any kind s needed; and a gas-producer (other than the coking plant and the blast-furnace) on a steel works is quite unnecessary, except, perhaps, as a stand-by in case of accident. This would apply to the whole output of ordinary structural steel. Of course, the question of the production of special high-grade steel (such as in the Sheffield trade), where complex heat treatment is required, stands in a different category. However, the facts in Mr. Mills's paper are of general importance, and not uninteresting to the gas industry, the whole future of which, with swelling competition, rests upon economical production and the making of he utmost of its products, through the best of methods and standards of quality. These are days of reorganization, of economy, and of topmost yields.

The Public and Exact Definition.

It is possible to be too precise under certain conditions; and one such condition is found in the heterogeneous mass which we call the community. In giving instructions to, or in imposing regulations governing action upon, the community, it is necessary that they be couched in such general erms that all who read will understand. But there are some ultraists who would have everything strictly defined n scientific language and quantities, which would only produce unbounded confusion. It is necessary for those who give instructions and make regulations to appreciate the difficulty of dealing with people the majority of whom know nothing whatever about scientific laws and determinations, and to render their instructions and regulations in a way that will produce the maximum effect in the direction desired. For example, how many of the millions of people who constitute the population of the Metropolis understand anything of foot-candles, and would comprehend what was meant if authority decreed that the maximum illumination thrown on to the street pavement from the windows of a shop or dwelling-house should only be some fraction of a foot-candle?

Yet there are grumblers over the new lighting regulations that have been brought into force in London. For these people, they are not sufficiently scientific or determinate. It is left too much to the individual understanding to say what such and such a term means. Yet within a week, the population of London have willingly complied with the new regulations in such a way that London in its shopping, business, and residential quarters is not what it was; and the authorities are pleasantly surprised to find that there is little of which they have had occasion to complain—in fact, now that they have seen what shopkeepers and householders can do in diminishing the illumination in the streets from irregularly used interior light sources, they are making arrangements for an increase on uniform lines from the public lamps which are not subject to the same variations as are the private lights. Scientific rule and regulation would have meant an army of scientifically trained inspectors, which we have not available for the work. The intensity of illumination, in connection with private premises, must be left as things are to the reasonable judgment of those who are responsible for the provision of the illumination, and those in whose hands control is placed. If there is dispute, then there could be reference to some independent qualified person.

Notwithstanding that London has now before it the result of a very intelligent appreciation of the new regulations, "Electrical Industries" speaks of them as "another official "rigmarole," which will throw "the trading community "and the householder into fresh confusion," which is just what has not happened. It would have had something more scientifically definite. It instances the regulation that "the intensity of the inside lighting of shops and shop "fronts must be reduced so that no more than a subdued "light is cast in any direction outside the premises." What, it asks, is a "subdued" light? Shopkeepers generally have given a very practical answer by what they have done; though we should be better pleased to have seen the subduing accomplished, in some cases, in a less crude fashion. Again, "all large lighted roof areas must be covered over, "or the lighting intensity be reduced to a minimum." What is the "minimum"? Our friends are hypercritical. The minimum could not be defined. It would be one thing from one set of conditions and another thing from another set. The maximum only could have been stated; and if shopkeepers and householders had been told that the maximum illumination allowed on the pavement from their private light sources would be 0·01 foot-candle, they would have been no better informed than before, and confusion would have been so great that the authorities would have been plagued almost out of their lives for instruction as to how the measurement could be effected, to decide whether the "maximum" was down to the numerically defined quantity. Again, "the lighting of railway stations, sidings, and goods "yards must be reduced to the intensity sufficient for the "safe conduct of business." Our contemporary here asks: "How is the railway company to know when it has struck "the happy medium which the Commissioners of Police of "the Metropolis and of the City of London consider suit-"able for the purposes of the Admiralty?" We put the converse question: How are the authorities to define "an "intensity sufficient for the safe conduct of business," unless they know all the conditions, and the ever-varying nature of the business proceeding in places such as those named? If it were possible to define generally the illumination for all such positions, the work of the illuminating engineer would be of a very thin order.

However, the regulations, which have been so well interpreted by the unscientific public, are considered too vague by our grumbling contemporary; and it is submitted that it would have been a very simple matter to have defined permissible illumination. Granted. The difficulty would have been to have got the public to appreciate what was meant; and ignorance of scientific terms and quantities, and incapacity for making measurements, would have been valid excuses for non-compliance. The authorities evidently appreciate the public better than the sticklers for mathematical precision; and by the result the authorities have proved themselves right.

French Gas Men and the War.

The French gas industry has had its problems, its difficulties, and its obligations, owing to the war, the same as, and in some respects more so than, the British gas industry. We get, through the report of the useful French Gas Professional Syndicate published this week, an insight into some of the pressing troubles and work that have arisen from the war. The Syndicate, we venture to say, has never been in the position to render such splendid and effective service to the French gas industry and the nation as it has accomplished during the period since war caused greater upheaval in France than here. In most practical manner, it has pursued the special work that came to its hand through the war. It not only inquired, and provided valuable intelligence, but it acted and helped, through the English coal markets, to obtain coal and secure its better distribution. Supplies and prices, transit and freight—all the same problems as here have been France's. The work regarding coal that has been done, and successfully, in this country by the gas industry, we are happy to feel, has been of benefit to our colleagues in France. The coal situation is now easier here than it was but a few months ago; and coal stocks are assuming quite respectable proportions. This being so, our French colleagues may take it for granted that their opportunities for making contracts for British coal are brighter to-day than they have been at any time during recent months. France, we know, must have coal at any price; but the correctness of the view that the easing of conditions in this country is having good effect there is shown by the large coal exports that have been recently made to France. As to sulphate of ammonia, tar, high explosives, and dyes, conditions have, in each and every respect, semblance with those obtaining here.

Costs for Handling Material.

Scattered here and there through the columns of the "JOURNAL" are to be found particulars as to costs of handling material by new plant representing the latest approved types. It would be of value if these particulars were more frequently supplied for publication, with a full explanation as to the character of the plant and the work done. Without such information, there is not much use giving cost data, as these must vary with different circumstances. In another part of the "JOURNAL" to-day, there appears a description, by M. Viktor Schön, of the coal and coke conveying plant at the Obuda Gas-Works at Budapest; and under the conditions there described, he shows that for tipping a 20-ton waggon, two men and 0·46 unit of electrical energy are required. The cost of this part of the work is 2·1d. per waggon, or 0·1d. per ton. This low result could not be realized with smaller waggons, or with more intermittent working. Breaking, elevating, and conveying the coal to the bunkers over the retort benches—the height to which the coal is raised being 82 feet—require three men and 36 kilowatts per hour—the cost working out to 0·43d. per ton. These two items make the low expenditure of 0·53d. per ton from tipping to deposit in the overhead bunkers. It is evident from this that the electrical energy works out at an extraordinarily low rate. A more serious business is the putting of the coal into store and taking it out again; the cost being 0·9d. for each operation per ton, or 1·8d. for the two. While eleven men are required for the work of storing, thirteen are needed for removing the coal from store, and conveying it to the place where it is to be carbonized. The consumption of electrical energy is rather less for the removal than for the storage, but, as seen, the number of men is more. To ascertain the nature of the plant by which these low costs are achieved, the interesting article must be read.

Collieries and Gas Coal Contracts.

The "Iron and Coal Trades Review," in their last issue, had an editorial article on the "Price of Coal (Limitation) Act," in which there are a few statements affecting gas undertakings which are based upon misinformation. In the first place, we see that the benevolent rulers in the coal industry are men who are very loth to engage in litigation; and the result is that many amicable settlements have been made on a basis considered by both parties to be as satisfactory as possible in the circumstances. Respecting the retrospective provision of the Act, notice of a wish to come under its provisions was to be given before the end of last month. Our contemporary states that it is "said that some, if not all, of the gas companies have resolved to abide by their compacts; the price to which gas has now been advanced, and the upward course of the market for residuals, having placed them in a very comfortable position financially." We should advise our contemporary to study the prices of gas stocks now and before the war, together with the dividends paid per cent.—not the return that would be received on an investment made at the prices now quoted for gas stocks. The gas industry has largely to thank the colliery owners and coal shippers for the high price of gas, the low dividends, and the present financial position. Not all gas undertakings have been able to make both ends meet on the first increase in price; and not a few have had to make a second advance. The article goes on to say that one speaker explained at a recent conference of gas engineers that gas companies regard the new Act with mixed feelings, as it has robbed the coal market of elasticity. Unfortunately for the "Review," this speaker did not represent the views of the gas industry generally; and he stands in a somewhat isolated position.

Discontent and Interpretation.

If the "Review" takes note of the report of the proceedings at the Wales and Monmouthshire Institution of Gas Engineers [see last week's issue], it will find there is a good deal of discontent among gas undertakings with the attitude of the colliery owners in connection with the Act. The dissatisfaction is not to be found only in Wales and the adjoining counties, but in other parts of England. It was through this, and the attempts of the coalowners to place obvious misinterpretations on the provisions of the Act in order, if possible, to secure additional advantage for themselves, that the Lancashire Commercial Section of the Manchester Institution of Gas Engineers approached the Board of Trade with the view of obtaining from them an opinion as to the construction to be placed upon certain clauses. The opinion [as seen in last week's "JOURNAL"] was diametrically opposed to the views of certain coalowners, and in favour of those of the gas undertakings. Lawyers who have considered the matter, on the cases submitted to them by colliery owners, have given opinions strangely, as a rule, coinciding with the desires of the colliery people. But after all the Board of Trade were responsible for the Act; they know what were their own intentions; and the final tribunal in the matter happens to be the Board, seeing that to the Board reference can be made by a Court of Law under any set of circumstances. We are glad the "Coal and Iron Trades Review" came across the interpretations of the Board in time to incorporate them as the final paragraph of their editorial, as they indicate (or rather would have done to readers of the "Review" if our contemporary had mentioned that the matter was referred to the Board of Trade by an organization connected with the gas industry) that gas undertakings are not altogether contented with the arrangements on which colliery owners would have preferred to settle differences, and that the colliery owners have wasted both time and money in taking Counsels' opinions, which they could use as a lever in gaining their own ends.

The Dyers' Grumble.

It is impossible to please everybody; and it is really no use trying. Every Britisher in the exercise of his prerogative, will grumble. Mr. Lennox Bertram Lee, the Chairman of the Calico Printers' Association, has been exercising his right at the annual meeting of that body. He has had his say; and nobody will be one penny the worse, nor will see that he has any substantial grounds for grievance. His complaint has to do with British Dyes, Limited, and with the Government having made a considerable investment in connection with the concern. Mr. Lee's opinion appears to be that, because the Government supported, by a large sum of money, the scheme for helping to save from starvation the opulent industries requiring dyes and colours, the result in dyes and colours should be open without hindrance to all purchasers. The logical conclusion of this is that those who did not co-operate financially with the Government should have equal rights with those who did—that is to say, that those who nearly succeeded in wrecking the scheme by standing aloof financially should now have par-purchasing rights with those who assisted the Government to float the scheme. We cannot see the equity of this. The trouble that touches home with the Calico Printers' Association is that, though one of the largest consumers of dyes in this country, they only bought 5000 shares in British Dyes, Limited; and now that the shareholders are receiving dyes in proportion to their holdings in the Company (which holdings should in a co-operative scheme have borne some relation to their position as consumers), the Association are greatly aggrieved and apparently much perturbed over the situation. If the largest backers of the scheme did not receive greater consideration than those who did not subscribe at all and those who did not subscribe according to their position, then a very real injustice would be done—an injustice which we should be better prepared to censure than we are to support the plaint of Mr. Lee, which has no substantial reason in it.

Progress of Trade Union Membership.

Since 1913 so much has happened that there is just now but little inclination—and in many cases little usefulness in doing so—to study conditions existing at that time, which under more ordinary circumstances would have claimed a considerable share of attention. Government statistics are always apt to be placed before the public in the shape of Blue-Books after a lapse of time which has robbed them of much of their interest, if not of their actual value. But it is necessary to make the best of them when they do come; and even though more than fourteen months of the war have intervened between the period to which the figures refer and the present date the significance of the contents of the report on trade unions for 1913, of the Chief Registrar of Friendly Societies, makes it worthy of note. From the report, it is learnt that the outstanding feature of registered trade unionism in the year with which it deals was the remarkable increase in membership, which is generally attributed to extended propaganda work and improved organization during a period of great industrial unrest. As a matter of fact, the membership of the 655 trade unions making returns in 1913 was 3,264,669, which showed the extraordinary increase of nearly three-quarters of a million as compared with the previous year—an increase which is by far the largest recorded in the history of registered trade unions. When seeking an explanation for this great display of activity, it was at first thought some unions might have included in their membership a number of members joining for State insurance purposes only. Inquiry proved that this was not the case, although the possibility is admitted that the influx of new members owing to the National Insurance Act which occurred in 1912 still continued to some extent during the following year. Among others enjoying this fuller measure of prosperity, the National Union of Gas Workers and General Labourers of Great Britain and Ireland, we are told, continued its rapid growth of recent years. During 1911 its membership, which for some years had been slightly over 30,000, rose to 77,000. In the following year, it reached 82,000; and at the end of 1913 it stood at nearly 135,000. Though the average contribution per member of a trade union was 6½d. per week, the total income was nearly £4,600,000; while the expenditure was only £3,700,000. This enabled a substantial sum to be added to the funds [which had been sadly depleted by the great coal strike in the preceding year], bringing them up to over £6,500,000, or roughly speaking £2 per member.

THE LATE MR. EDWARD ALLEN AND THE AMERICAN GAS CONGRESS.

A Posthumous Contribution to Gas Literature.

Readers may be reminded that last Spring it had been arranged that Mr. Allen (accompanied by his wife) should attend the International Gas Congress at San Francisco as a representative of the Institution of Gas Engineers; and he made himself responsible for securing contributions from representative gas engineers in England under the inclusive title of "A Review of the Present Practices in the Manufacture and Distribution of Gas by British Undertakings." Unfortunately, the European war and Mr. Allen's death in July prevented the idea being fully realized; but he had at the time secured four of the five papers to be included in the projected "Symposium," and had himself written the "Introduction." This appears in the pamphlet issued in connection with the meeting; and it will be interesting to reproduce it in full, as the last of many contributions he made to technical literature. It is as follows:

> In offering the following series of papers, it is a matter of great regret that I am unable to attend the congress to be held at San Francisco in September.
>
> The invitation given to the Institution of Gas Engineers at the annual meeting held in Liverpool in June of last year to send a representative, was highly appreciated by the members, and the choice fell upon the President at that time.
>
> Dr. Elliott was the American representative, and gave a very kind and hearty invitation to all the members who might be able to visit San Francisco; and he was good enough to invite me and my wife to be his guests at New York before making the journey to the congress.
>
> Unfortunately, the great war which commenced early last August has made it impossible for me to keep my promise; and I earnestly beg to be excused under the unforeseen circumstances that have arisen.
>
> It is my duty and privilege, on behalf of our Institution, to present a resolution of profound respect and admiration for your great Institution, and the hope that the proceedings at San Francisco will realize your highest expectations.
>
> The bond of friendship and goodwill that unites the gas industries of this country and your great Continent is growing stronger year by year, and shares a part in the union between our countries that is highly valued and appreciated at the present time and that shall never be broken.
>
> In my position as Engineer to the Liverpool Gas Company, I feel a special interest in the gas industry of the United States of America. The port of Liverpool is closely connected with your country, as the usual place of arrival and departure of American visitors.
>
> In my early days, the gas engineers visited our offices and works; and I retain clear memories of General Roome and the Greenoughs (father and son) visiting the late Mr. Alfred King and my esteemed predecessor, Mr. William King. Since that time there is a long list of distinguished gas engineers who have been honoured visitors to our shores.
>
> It would be difficult to fully describe the benefits received in our industry from American engineers. Contributions have been made to the annual meetings of our Institution by your members during past years, to our great advantage.
>
> No doubt the early installations of coal-gas plant in America were copies of those in England at that time; but a corresponding course was followed in this country in regard to carburetted water-gas installations when the plant made perfect by the United Gas Improvement Company, of New York, was introduced more than twenty years ago by Dr. Humphreys and Mr. Glasgow, to the great advantage of many undertakings. It is interesting to note that the first order was given by the Liverpool Gas Company, and the plant set to work early in 1895.
>
> It is a matter of great satisfaction that in each country full information is given about all new plant and machinery on gas-works; also of all improvements made in old apparatus and processes of manufacture and distribution.
>
> Your National Commercial Gas Association and the British Commercial Gas Association are running on similar lines; and there are many members with joint interests in these two important organizations.
>
> The series of papers now submitted to the conference is not intended to present novel features, but is a review of the usual practice in this country which it is hoped will be interesting to our American colleagues. The author of each paper is a recognized authority on the subject dealt with, and is respectfully presented to this great assembly of American engineers.
>
> I have the honour to be, &c.,
>
> Edward Allen, M.Inst.C.E.,
> Past-President of the Institution of Gas Engineers.

Of the series of papers referred to above, abstracts of those by Dr. W. B. Davidson, Mr. J. Ferguson Bell, Mr. Walter Hole, and Mr. F. W. Goodenough were published in the "Journal" for Sept. 28, pp. 699-701. The other paper intended to be included in the "Symposium"—that by Mr. John Bond, on "Carbonization"—was not sent forward for the Congress. Mr. Bond explains that he found it was impossible to do justice to the subject in the time at his disposal. As most of our readers know Mr. Bond has now for many months past been fully occupied on toluol extraction—more especially of late, since he undertook the work which Mr. Allen had in hand at the time of his death.

Cablegram to the Institution of Gas Engineers.

In connection with the above, the following cablegram was received last Tuesday by Mr. W. T. Dunn, the Secretary of the Institution of Gas Engineers:—

> Greetings from California. By resolution, the International Gas Congress thank the Institution for Symposium on "Gas Manufacture and Distribution," and wish you to convey to Mrs. Allen our sense of obligation and personal sympathy. We cordially reciprocate sentiments expressed in the last paragraph of Mr. Goodenough's paper.
>
> Alex. C. Humphreys, President.
> George G. Ramsdell, Secretary.

The last paragraph of Mr. Goodenough's paper here referred to reads as follows:—

> If our review of what has been and what needs to be done leads us to a firmer conviction that, above all, our policy must be sound from top to bottom, broad based upon the principle of efficient service, and to a clearer vision of how that policy may best be pursued, we shall have usefully spent our time, and will go forward to greater success than we have yet achieved. Progressive ideas are spreading rapidly in the gas industry on both sides of the ocean. The National [might it not be now called the American ?] Commercial Gas Association has done a great work in that land of progress towards which in these times of stress we more than ever look for co-operation and comradeship. The British Commercial Gas Association is doing its best to forward the cause of efficiency in [may we still call it ?] the Mother Country and her overseas dominions. May we long go forward side by side, mutually stimulating and encouraging each other, believing with Robert Louis Stevenson that "an aspiration is a joy for ever, a possession as solid as a landed estate, a fortune we can never exhaust, and which gives us year by year a revenue of pleasurable activity," and so travel hopefully together towards the unattainable ideal of perfection, in the service of the public and of the great industry in which we are engaged.

ELECTRICITY SUPPLY MEMORANDA.

Budget and Business.

We are all viewing the incidences, individually and industrially of the Budget in the most philosophic spirit as being among the things that cannot be avoided, and so must be endured. What we have to do is to exert ourselves to make as many 18s. (or thereabouts), 17s., or 16s. 6d. in the pound as we can; and this can only be done by pursuing business to the full extent of our power, and that "full extent" is not by forsaking any of the methods of promoting business. The more pounds that can be made, the better individually and for the country. Besides, there is always a hereafter; and the hereafter will not benefit by cutting ourselves adrift in the present. However, there are not many among us who can detect anything in the Budget over which to be really jubilant. We congratulate "Meteor" of the "Electrical Times" upon finding something in Mr. M'Kenna's proposals over which to be so. The electrical industry has been very busy in the past helping—by good orders for electrical plant, lamps, and other appliances, and by supporting German capitalized companies in this country—to finance Germany, and to strengthen it for carrying on war against this and other countries. All the orders that have gone to Germany which could have been avoided have been so much the worse for this country. "Meteor" sees in the adoption of protection as a temporary war expedient the beginning of something that will probably be more permanent. If so, and the range of things on which import duties are placed is increased, the range may reach electrical apparatus and appliances, so that the home producing industries may profit. Now our political and financial monitors advise us that what the country must do is to reduce its imports as far as it can conveniently do so, and increase its exports to the greatest possible degree. If this is good procedure for war times, it is good for peace times. There is no possible evasion of this fact. But, despite the counsel of high authority, "Meteor" is grieved to find that orders for electrical plant and goods are still going abroad. Patriotism ought surely to prevent this being so; and he thinks that what persuasion will not do, a 33⅓ per cent. impost would effect. We are only at the parting of the ways in this matter; and our friend believes that the ways will diverge more and more. If motor-cars, why not electrical plant and other goods? "Meteor" feels hopeful; and British electrical plant manufacturers are hopeful with him.

Eliminating Dear Fuel Costs by Higher Efficiency.

Advisers of the electricity supply industry are generally of the optimistic order. Everything is plain sailing. The managers of the industry have only to say "do," and it is done. It must be nice to be able to command, and to know that the issue of the command is an assurance of fulfilment. If this were not fancy but reality, the electricity undertakings of the country would all be healthy and wealthy, instead of as many of them are to-day strugglers with very adverse conditions. An "Engineering Correspondent" of "The Times Engineering Supplement" has been writing on "Electric Supply Policy and Commercial Prospects." If his policy is followed, there need be (according to his writing) no more heavy hearts among central station engineers and managers, but all will be well and bright. There is dear fuel to-day. Well, dear fuel can be laughed at; for have not steam-turbines the past few years largely discounted the influence of fuel cost upon general policy? There is a large quantity of plant in existence which will not bear comparison with what manufacturers can now produce; but as soon as the Treasury is kind enough to sanction expenditure, there will be a brisk demand for high pressure and mixed pressure turbines. Then the aggregate saving in coal consumption resulting from a general movement of reorganization will reach very high figures; and so "Engineering Correspondent" is confident that sooner or later plant efficiency will defeat dear coal, and will enable the managers of generating-stations to ignore this consideration in connection with their plans for pushing business. It sounds almost like a fairy tale. Fancy being in the position to ignore dear coal! The prospect is too good. But central station engineers with practical facts facing them on all sides will not be disposed to accept the imaginings of such an adviser. Engine efficiency is not the sole factor in low costs. Demand is a factor; and so is the nature of the demand. Another thing is that it depends on the amount of work the steam-turbine has to do whether it is a cheap prime mover. There are other power agents that are equally cheap for low horse powers. Another matter that the central station engineer has to consider is the question of capital. Capital expenditure already incurred cannot be pitched on to the scrap-heap without very serious consideration by many electrical engineers to-day. It is not sufficient that fresh plant comes along that is more efficient than the plant in existence. The efficiency must be such that it will produce economies that will pay interest and liquidate the outlay on the discarded plant, as well as perform the same service on its own behalf. Unless it can do this under the conditions of a concern, then there would not be economy in effecting the change.

At the Trading End.

From the efficiency question, "Engineering Correspondent" passes on to consider commercial policy. While the manufacturers are blessing the central station engineer with more economical machinery, their market is being disturbed by more economical appliances being supplied at the consumer's end of the cable—thus restricting demand, and so limiting the field for generating plant. "Engineering Correspondent" does not say anything about plant efficiency not compensating, through lower generating costs, for the loss of consumption. He thinks that current sold by meter for lighting will have to be priced at a higher rate, or a large addition to the number of consumers must be secured. We have heard these ingenious proposals before. But the central station engineer looks at the price being charged for gas, thinks in B.Th.U., and pauses before recommending an increase in the price of electrical current. And as to the increase in consumers—well "must" is a very strong word to precede "be secured." The securing, too, is very difficult; and the difficulty becomes greater with experience. In the course of our travels, we met a man the other day who has had the electric light turned out of his living rooms, because the whole of the members of his family said they could not see print so well by its aid as they could do by the help of a neighbour's inverted incandescent gas-lights. And the neighbour with the incandescent gas-lights will not change over to electricity because of the experience in the electrically lighted house of his neighbour. Another neighbour who used to be somewhat extravagant with electric-radiators states that he is exercising economy by using a coal fire in his morning room, and a gas-fire in his dining-room, because now that the novelty of the electric "heaters" has expended itself, the members of his family assert that they are frauds. As to domestic electric cooking, the more experience there is of its shortcomings and inadaptability to all requirements, the less likelihood is there of any permanence in the use of the process. Progress with it is extremely slow even in the districts of the most persevering electrical men. However, "Engineering Correspondent" thinks a flexible tariff—we suppose he refers to something in the way of the rateable-value-*cum*-point-five system of charging—would be the thing to override all difficulties. Evidently, he believes that some electricity concerns by putting up their electricity charges, owing to high-fuel costs, by 10, 12½, or 15 per cent., have gone beyond what is necessary, because he advises that where such increases bring in sums that are more than sufficient to balance the greater cost of production, the extra profit made should be earmarked for use as working capital, "particularly for application to the business of letting out domestic apparatus like cookers or vacuum cleaners, the initial cost of which limits their use in middle-class houses." Most electric undertakings will want all the extra revenue arising from the addition to their prices.

Indefiniteness.

We have read the first part of an article in the "Electrical Review" on "The Problem of the 'Point-Five' Tariff." Such articles are read because one is fond of exploring writings of the kind to ascertain whether, by any mischance, there is something new in them. If there is, it ought not to be overlooked by us. This first instalment of the article does not contain anything very new; and the writer does not appear to be quite certain of himself or his points, as only in the first column he uses the expression "seems" or "seem" no less than five times: "It *seems* no overstatement of the case to say that really important development in domestic heating and cooking depends on energy being available at 0·5d. per unit (or less);" "heating and cooking apparatus *seems* at last to be emerging on a commercially and technically satisfactory basis;" "it *seems* quite certain that a uniform flat-rate can only be justified by practically a 100 per cent. station load factor, since no improvement in storage cells can make the storage of electrical energy as simple, cheap, and efficient as the purely mechanical storage of gas in gasometers [gasholders];" "the majority of existing 'point-five' undertakings assess fixed charges on the basis of rateable value, and it would *seem* that there is considerable risk of this becoming standard practice." Then he proceeds to set out arguments, figures, and curves, which "*seem*" to him "to demonstrate conclusively that the rateable value basis is not equitable." From this, it is clear that the person who communicated the article is wandering about in a state of indefiniteness. There is little that is positive; things merely "seem" to be something or other. However, it is interesting to know that the writer has got so near conviction as to believe that current must be supplied at ½d., or less, per unit before there can be any hope of it making any material headway for domestic cooking. It is equally interesting to know that heating and cooking arrangements only "seem" to be emerging from the state which has so long kept them from gaining any general popularity. It is further interesting to have the electrical recognition that storage differentiates considerably between the status of electrical energy and that of gas. Rateable value as a basis for charging has not only seemed to us, but it has been definitely declared by us, to be inequitable. We hope our indefinite friend will consider whether there is not such inequity as to make the system give preference to some consumers, and so produce an illegality.

Point-Five Inequity.

The points that are made in the first article to show that rateable value as a basis of charge is inequitable have been previously recognized. The first is that the assessment of a house is no criterion whatever as to its electricity consuming capacity. While one house may be just as large as another, the size and habits of the family may be altogether different. Then the writer points out that, if allowance is to be made for the effect on rateable value of a specially large or small garden (as seems essential), he rateable value tariff at once loses its merits of simplicity and power of being easily understood by the layman. In fixing on a percentage upon rateable value, it is usual to analyze previous accounts to see what percentage will, with the 0·5d. per unit, yield he same revenue as from the previous flat-rate. This method of arriving at a percentage is described as a tedious one, which does not assure that the percentage will not be wide of the mark in ndividual cases, and suitable under the new conditions which it is desired to bring about by the new tariff. The same percentage applied to differently rated houses helps to produce a largely varying charge per unit, according to the consumption. The consumption may be no more in the heavily rated house than in the other one, though the hypothesis is that it should be considerably more. Take a house rated at £20 and another rated at £60, and a 15 per cent. charge on these figures. Supposing both use 500 units per annum. What happens? The lower rated house pays 1·44d. per unit through the fixed charge; the higher rated one 4·32d. The addition of the 0·5d. per unit makes 1·94d. and 4·82d. per unit respectively. What equity is there in this? These are extreme conditions; but they may be found in low-rated houses and highly-rated flats in a residential district. Inequity stamps the rateable system from beginning to end.

A Breakdown. In the seat of cheap electrical energy, the Newcastle and Gateshead Gas Company supply about 750 million cubic feet of gas per annum for industrial purposes—a large proportion of it being for power. This fact alone in the experience of the one company stands out big and strong against the silly notices that the electrical papers give, and make much of, when an electric-motor displaces a gas-engine. Another fact is that the gas-engine makers were remarkably busy before the war, and have been so since. Some makers have had to extend their works in order to cope with production; and their dividends the last few years have not shown any disposition to shrink. Notwithstanding, according to "Electrical Industries," the "JOURNAL" has been trying to "revive" the case for the gas-engine against electric-motors; and, of course, also according to our electrical contemporary, the articles that were recently published by us from the pen and actual experiences of Mr. Widlake, gave "proof" of the poverty of argument which afflicts the advocates of central driving by gas-engines. This is the contemporary that made such an awful mess when it attempted to criticize these articles, and carefully avoided reference to the actual cost per B.H.P., whereas in Mr. Widlake's articles he showed that this basis was the one on which the respective merits of the rival motors should be fought out. Our electrical contemporary says it has known cases in which electric supply undertakings have kept electric-motors in reserve for the day when a particular engine would give up the ghost. In other words, the electrical people can only effect a change in some factories by letting capital in electric-motors lie idle while waiting for the collapse of a veteran gas-engine. The writer proceeds to refer to a definite case, in which the proprietor of a factory had electric power in one department, but not in another where there was a gas-engine. He did not, however, feel disposed to offhand supplant the gas-engine by electric-motors, even though by appearances it was very old; and apparently, without trying a modern gas-engine, he seems to have made up his mind to have an electric-motor in its stead when the old gas-engine became incapacitated. The day came when the gas-engine succumbed to the infirmities developed by old-age; and then, and not till then, two motors succeeded it.

Pertinent Points. Well, now, is there anything remarkable in a gas-engine or any other piece of machinery being unable to resist the ravages of age and hard work? It does not require any great strain on the memory to recall instances of armatures, field coils, &c., of electric-motors getting burned out, with precisely the same—perhaps even greater—dislocating effect upon the plant they are driving as the gas-engine defects alluded to would have. Spare parts for a gas-engine may be kept as easily as spare armatures and field coils for an electric-motor. Further, no mention is made in the article of the age of the gas-engine in question or of the work it had done. Looking at the illustrations, it appears to be an old type of Crossley engine which, by all rules of depreciation, had reached the old-iron stage long before the defects mentioned occurred. If "Electrical Industries" wants its arguments to carry weight, why does it not take a concrete example, and compare on a cost basis a gas-engine and an electric-motor—both of modern type and doing equal work. We have called the attention of our contemporary before to an article published in our columns in connection with the displacement of an electric-motor by an old gas-engine, and asked it to criticize the facts contained therein—facts as to costs and work done [*see* "JOURNAL" for June 22 last, p. 695]. But it has not complied.

Scottish Junior Gas Association (Eastern District).—The opening business meeting of the Association for the session 1915-16 will take place next Saturday, in the Heriot Watt College, Edinburgh, when Mr. J. D. Luck, of Markinch, will read a paper entitled "Distribution Extensions and Alterations at Markinch." There will be subsequent meetings on Nov. 14 at Perth, Feb. 6 at Dunfermline, and April 23, the annual meeting in Edinburgh.

WAR-TIME GAS PROBLEMS IN FRANCE.

SOME short while since [in our issue for Aug. 10, p. 284], we made brief reference to the work of the French Gas Professional Syndicate (the "Syndicat Professionnel de l'Industrie du Gaz") and particularly to the matters with which it has had to deal as the result of the European war.

The report of the Syndicate for the year 1914 is a quarto publication of fifty pages, largely devoted to the business questions connected with the gas industry which are peculiar to France, and thus dealing at length with labour matters, legal decisions, and with the propagandist work which in normal times forms a large part of the activity of the Syndicate. The interest of these subjects, however, is overshadowed by the special measures the Syndicate carried out. with very commendable promptness and discretion, in its endeavour to assist gas undertakings in France in bridging-over the difficult months which followed the outbreak of war. Although the report refers only to the year 1914, and therefore covers only the first five months of the war, yet the bare recital of the problems presented to the French gas industry in that period, and of the Syndicate's steps in dealing with them, runs to a length which is, in itself, an indication of the difficulties of the task, cheerfully assumed by our French *confrères*. Their difficulties were in many respects greater than ours, though of like nature—viz., the purchase and transport of coal, and the disposal of coke, tar, sulphate, &c., in the exceptional conditions suddenly created by the war. It may be of interest if we publish, as we do below, an abridged account of the experiences recorded in the report, for the reasons that many of them are intimately connected with conditions in this country, and that the Syndicate in certain cases outlines measures which may be taken for the protection of gas interests after the war.

The declaration of war in August last year found the Syndicate prorogued for its regular summer vacation; but meetings were quickly summoned in Paris of those members not taken away by military or other duties. It was then resolved that the Syndicate should devote itself, in a broad national spirit, to the service of gas undertakings throughout France—whether members of the Syndicate or otherwise, and should at the same time hold itself in readiness for taking their full share in the organization of the defence of the country. It thus at once placed itself in communication with the War Department. Its first step was the purchase of 100,000 tonnes of coal (subsequently raised to 120,000 tonnes) in England, and the establishment at Bordeaux (at the time of the removal of the Government to the town) of a bureau for the supply of coal and its distribution throughout the country according to local requirements. At the same time, it made other purchases of English coals required by various French gas-works; England being almost the only source of supply, and one able to make itself responsible for transport.

The bureau at Bordeaux, under the direction of M. Décluy, and in conjunction with the Syndicate in Paris, thus rendered most valuable service in controlling the supply of coal, in avoiding delays, and in supervising the distribution of coke. On the return of the War Department to Paris, the bureau was closed. In the case of many gas-works, the situation in the first months of the war was saved by the organized purchase and distribution of coal—a system which since then has been consistently applied for the purpose of ensuring supplies and effecting economies. This work, although admittedly incomplete, has been carried out at great personal sacrifices on the part of members of the Syndicate.

A further matter which has most seriously engaged the attention of the Syndicate is the legality of contracts made in times of peace, in view of the world-wide disturbance of the cost of raw materials and of transport. The report quotes M. Larnaude, a Professor of Law of Paris and President of the National Committee for dealing with damages sustained as the result of the war, to the effect: "Jurists must not continue to treat the war as a simple chance event or *force majeure* in its application to those who suffer from it. Any such view and such terms do not fit present times. They must be expunged from our laws and our judgments." The Syndicate interprets the opinion thus expressed by a high authority as fully justifying the demand for the amelioration of losses by those who can, and in common justice should, take their share to this end. Some municipal authorities have not hesitated to consent to increases in the price of gas—varying according to circumstances. They realized that they could not leave the public services entrusted to their concessionaires to suffer, and that ordinary prudence forbade them, now more than at any time, to burden themselves with so heavy a load. Examples such as these find a following, particularly with the approval of communal authorities, who are the persons best informed as to the need of gas and electricity for railway stations, hospitals, and depôts engaged in the national defence.

The Syndicate refers to its efforts—fruitless up to now—made with the object of obtaining Government intervention in the supply and transport of coal for gas making. In this connection, it quotes the similar demands for intervention made in this country by the "JOURNAL." The action of English gas companies in raising the price of gas is recognized by French undertakings as the means to be adopted for the remedy of the misfortunes arising from the war. In reviewing the question of coal supply during 1914, the Syndicate notes first a slackening of the

French production at the beginning of the period, as a result of the suppression of long workings and of the operation of the three-year law which withdrew more men for military service than in the previous year. Coal from the Nord and Pas-de-Calais districts was 3½ fr. to 4 fr. dearer than in 1912; while there were delays in delivery. In June, the price of Belgian coal fell 1 fr.; in the Loire, a strike in March had serious consequences; and in l'Aveyron and the Tarn, prices steadily advanced.

Such were the conditions when, with the outbreak of war, supplies were entirely upset by the almost complete occupation of the Nord and Pas de Calais districts. Only two mines (one under enemy fire) remained for the supply of a certain number of gas-works under conditions of regular delivery and of price, which, after making allowances for the circumstances, prompted complaint by customers. Subsequently, their deliveries were further reduced, in consequence of military demands.

The Syndicate has continuously examined the means for improving the facilities for the transport of coal, both by rail and canal, to works in the worse-situated districts—such as in the Central and South-Eastern parts of France. It also undertook active negotiations with a view to obtaining more favourable terms for transport over the "P.L.M." railway system—the existing tariff being drafted for the benefit of mines in the Loire and Saone-et-Loire districts. The suggestion has been made that the tariff should apply in both directions of travel; but the matter stands adjourned for the present.

The report then proceeds to dwell upon the course of the price of English coals which had advanced towards the end of 1911, and reached a very high figure in 1912, owing to the general coal strike of that year. French gas-works using English coal likewise felt the effect of the Balkan and Turco-Italian wars. These high prices were maintained during 1913; and at the beginning of 1914 first-quality coal and Special Wear coal stood at 15s. 6d. to 15s. 9d. per ton, as compared with 9s. 9d. and 10s. 6d. in January, 1911. These prices fell slightly in the early part of 1914. The report quotes the figures published in the "JOURNAL" of the coal prices in 1914-15—pointing out that, contrary to expectation, they were slightly lower during the second three months of the war, as the result of the closing of certain markets. Transactions took place as usual, except that in some instances payment was asked for in advance of shipment.

The question of coal prices in the English market, however, is of such importance to the French companies that the Syndicate extends the scope of its report into 1915 in order to deal with it. It notes the sharp general but small fall in the cost of freight in the early part of the present year and contemporaneous with the annulment by the mines of arrears on order, and in some instances even of arrears going back to Dec. 31. The majority refused to make contracts for a period; while in some contracts which were sealed, the possibility of fresh restrictions—and particularly a tax on exported coal—could be discerned. On this account demands were, in fact, made last year—upon the London gas companies, among others. The ground on which the advance in coal prices is justified by the mines—viz., the lessened production due to the enlistment of (according to some statements) 25 per cent. of the miners—is dismissed by the Syndicate as inadequate, in view of the lesser export, as shown by the British Board of Trade figures. These record a reduction in the first three months of 1915 of over 2½ million tonnes in comparison with 1914. The report also regards as a means of increased production (on which mine-owners may count, if necessary) the suspension by the Government of the Eight Hours Act. The general conclusion, drawn from the opinions of gas-makers in the country, is that the situation will become easier; so that it would be unwise to make contracts at the unreasonable prices now ruling [this refers to mid-April last]; yet at the same time the Syndicate recognized that the supply of English coal was a matter of such importance that it hesitated to advise its members emphatically one way or another.

Reviewing the universal rise in the cost of freights, the Syndicate regards as a last resource the purchase of coal supplies from the United States, as was done in France in 1900. However, at the outbreak of war American coals cost 20s. 6d. to 22s. 6d.; and the Syndicate regards this source as of service only in the event of further advances in the price of English coal and in cost of shipment from England. For the present, it is more directly concerned with the alarming increase of the latter item, which it is ready to recognize, on one part, as the result of the requisition of many steamers by the Government and of the interference with navigation by German submarines; but equally, on the other hand, of the action of shippers, who, like coal owners, have taken undue advantage of the situation.

The report quotes the protests against freight charges made by British gas-makers, and instances that of 15s. from Newcastle to London, as compared with less than 3s. in normal times. It notes with approval the establishment of the "London Coal Supply Advisory Committee," with its object, among others, of employing seized enemy ships at reasonable freightage rates. In addition to greatly enhanced freight charges, the crowding of French ports has led to additional demurrage charges, amounting in one instance (at Treport) to 10 fr. per tonne. The freightage outlook is one which the Syndicate feels it has not painted in unduly black colours, in which view it is confirmed by M. Capuron as the result of a visit by him to England for the purpose of further investigating on the spot this question and that of coal prices. Even were the prices of English coal maintained at a reasonable level by State control, the cost of shipment remains a serious factor for the French gas industry. As regards the use of enemy vessels seized by England, French participation in the scheme would appear to be barred by the excessive price asked for the ships.

As regards the sale of coke, the market followed a normal course during the greater part of 1914. The stocks recorded each month by the French Central Coke Committee showed unimportant variations. Gas makers have had reason to be grateful to the Committee for its labours in forwarding the industrial use of coke in many directions, and for the relations established by it between gas-works and the district unions. In England, in March, 1914, Durham coke was freely offered; and the January price of 16s. to 17s. fell to 13s. to 12s. towards July—rising to 18s. 9d. to 19s. in February, 1915. Similarly, in France the price of coke has lagged greatly behind that of coal. Difficulties of distribution by rail and canal have led to gas-works in the West and Midi finding themselves overstocked with coke, while other districts had none. Equilibrium was restored on application by the War Department to the Syndicate in January, 1914, as the result of which supplies available in individual works in the West and Midi were taken by the War Department at the price of 35 fr. to 40 fr., according to locality, instead of the 30 fr. first suggested but recognized as too low in regard to the constantly increasing cost of coal. In many cases, sales of coke were fixed by contracts made for the winter of 1913-14; while it was found difficult to raise the price of coal for domestic use. The same thing applied to other sales, where the scarcity of labour and cartage was an obstacle.

These retail sales moreover were a small fraction of the total supply, which latter (after deduction of dust and waste) scarcely exceeded two-thirds of the coke obtained from the retorts. In short, the serious rise in the price of coal was counterbalanced only to a very slight extent by the sales of coke, while other bye-products (such as sulphate and tar) suffered great reductions in price in 1914.

The report recalls the fact of the formation, in November, 1913, of the French National Lighting Committee, which, at the time of the outbreak of war, was composed of thirty-five members. It held several meetings during the first part of 1914, under the presidency of M. Violle, in order to formulate the course of its labours, roughly broken off by the dispersion of its members, of whom a number are with the colours. It is too soon to say when the different National Lighting Committees will be able to resume their work, or what will happen to the International Lighting Committee; but the fact that the formation of this last Committee dates from the special meeting of the International Photometric Commission held in Berlin in August, 1913, is sufficient ground for belief that its constitution will undergo radical changes.

A note issued by the Syndicate in February, 1914, gave particulars of recent contracts with regard to the supply of gas, conceding either a lower photometric value or the substitution of a reasonable calorific power for the photometric standard. The contracts likewise admit a certain latitude in the carrying out of the tests; and in two cases the use of water gas has been authorized under conditions which do not nullify the value of the addition. The national crisis has led French gas-makers to condemn more emphatically than on the occasion of coal strikes, there and in this country, the injurious opposition and short-sightedness of those who, under the cloak of hygiene, have placed obstacles to the use made of water gas in every other country, and have thus deprived the French gas industry of a most valuable means of husbanding its coal supplies and effecting financial economies.

As regards sulphate of ammonia, the report reviews, at a length which cannot be usefully translated in similar detail, the conditions before and during the war. It refers to the cutting campaign of the German Syndicate in November, 1913, and to the large excess importations of nitrate in the first half year of 1914 as compared with 1913. Similarly, Belgium and Germany, it is estimated, exported sulphate in the same period in quantity exceeding by over 30,000 tonnes that of the corresponding period of 1913. Since the outbreak of war the two chief producers have been England and the United States; while in France the market was good at first for various reasons—such as the infrequency and the higher freightage cost of English supplies, sales to Italy, and the requisition of nearly all nitrate by the War Department. Since then, however, supplies of sulphate were reserved for the munition service, with the exception of those from some few small gas-works; and the trade has thus come to a standstill. In view, however, of the very slight use of sulphate as a fertilizer in France during the autumn of last year and the spring of the present year, the Syndicate anticipated a great demand during this autumn. Beyond this period, the position will naturally depend more upon the general course of events than upon technical and commercial factors, although among these latter the Syndicate takes within its purview the production of competing synthetic fertilizers, from Norway, Sweden, and America—*e.g.*, nitrate of lime, cyanamide, and ammonia. The last-named threatened to be produced upon an enormous scale in Germany—on a scale large enough, as is now reported in Germany, to cover not only the requirements for the production of explosives but to enable the country to dispense afterwards with imported nitrate. No one can foretell the end of these vast schemes; but the Syndicate feels no doubt that the war, while imposing progress in the production of materials for military use, will likewise lead to results of benefit to peaceful industry.

As regards tar, the Syndicate is able to point with pride to the service which it has rendered alike to the French gas industry and to the French nation in conserving and distributing this esidual for military purposes. The importance of tar as a raw naterial in the production of explosives was fully recognized by he French authorities at quite an early stage of the war; but the tilization of the whole tar production in France has involved nany delicate negotiations, in which the Syndicate—in the person f M. Décluy, seconded by M. Masse—has most ably taken a course in the national interest, and has been instrumental in harnonizing the separate interests of gas-makers and tar-distillers, vithout at any instant losing sight of the prime necessity of nsuring first the complete extraction from the tar of materials or the manufacture of explosives.

Its first business was to ascertain the quantity of tar in stock n the country, and to prepare figures of the national production o be expected in the altered conditions. Returns were obtained rom 390 gas concerns—not including the large lighting companies n Paris and of lighting, heating, and power in Lyons, Marseilles, nd St. Etienne. It then, under orders of the War Department, ook steps to organize the distribution of this tonnage among the listilleries, in accordance with geographical position and ability o conform to Government requirements. One most important part of this work lay in bridging the gulf between the price which he gas-makers could justly demand and that which distillers delared themselves able to pay. Concessions were necessary in he interests of both parties, and no less in those of the Treasury; but through the indefatigable labours of MM. Décluy and Masse he national aim was fully attained.

In September and October, 1914, the Syndicate issued succesive letters—the first, emphasizing the importance of tar in the lefence of the country, and the second pointing out distilleries in he respective districts with which gas-makers should communiate. Many gas-works acted in accordance with these suggesions, though others—from inability to come to terms with disillers, and prompted by the high price of coal—used tar as fuel. The result of the Syndicate's recommendations was, however, to obtain the distillation of more than half the total tar production of France for the use of the Munitions Service. In November, 914, at the request of the War Department that the whole of the gas tar in the country should be so applied, the Syndicate esablished a special department to work in collaboration with the Government to whom the Syndicate, a week or two later, appealed for intervention in the question of price—pointing out that n the absence of such intervention gas-makers had taken measures to comply with the requirements of the State. In January, 915, the Syndicate was able to report to the Government that 933 tonnes had been supplied to tar distilleries from Nov. 1 to Dec. 15, 1914; that works held 22,262 tonnes; and that the estinated production to the end of June, 1915, was 35,136 tonnes—naking a total of 61,331 tonnes.

A month later the Syndicate was entrusted by the Governnent with the duty of ensuring the delivery to the distilleries of all tar made in the gas-works throughout France, and was asked to check the extraction by the distillers of all the products of service in the manufacture of explosives, and to deliver these products to the Munitions Service. Of these three commissions he Syndicate discharged, and is still discharging, the first. As egards the others, it placed itself at the disposal of the Munitions Service—its powers and constitution not permitting it to underake control of the distilleries. Thus, by collaboration with the Government, the whole production of tar has been reserved for he manufacture of explosives; and the use of tar as fuel, or its ale for purposes other than the extraction of materials for the Munitions Service, has been forbidden. Every gas-works without exception accepted these conditions; and the Syndicate is able o say that no tar is, nor will be, distilled except for the requirenents of the national defence. Moreover, every gas-works has greed to the net price of 35 fr. fixed by the Government.

Benzol, from April to August, 1914, stood somewhat low in price—26 fr. in Paris. With the removal of German supplies, he prices reached 42 fr. The market then became entirely restricted. All supplies were requisitioned. Benzol and its homoogues, and more particularly toluol, were the hydrocarbons of ar of prime importance in the manufacture of explosives. Its uture movements are, of course, uncertain. The production will rise a little in France, and considerably in the United Kingdom; but it is too soon to speculate on the German supplies or on the steps to be taken in regard to them.

The Syndicate concludes its report by a brief reference to the effect of the war upon industries engaged in the manufacture of refined products—such as dyes, drugs, and perfumes derived from coal tar—the trade in which Germany has attained world-wide predominance. In regard to dyes, it is mentioned that the endeavours of Great Britain and the United States to establish this ndustry within their frontiers have had an equivalent in France. For example, a "Research Company" has been formed in Lyons to go into the matter. France is anxious to regain an industry of which (with England) it was one of the founders, and in which formerly it took a leading part. In so doing, it would be revenged upon the Germans, whose work on the synthetic production of alizarine has been the ruin of the cultivation of madder throughout a part of the Midi. It appears that inquiries as to the production of gas tar have been made by scientific men apparently to this end; but, the Syndicate very properly remarks, gas tar must cease to be necessary for munition purposes before anything can be done.

PERSONAL.

Captain F. J. Bywater, of the Royal Engineers, was, we learn from the "Birmingham Gas Department Magazine," in that neighbourhood about the middle of last month, on leave, prior to proceeding to France.

The position of Manager and Secretary to the Cromer Gas Company has been filled by the selection of Mr. Samuel Carpenter, late of Dorking. The vacancy occurred through the appointment, as mentioned in last week's "Journal," of Mr. F. Smallbone as Assistant-Engineer of the Brighton and Hove General Gas Company.

In intimating in last week's "Journal" the retirement of Mr. Joseph Cash, M.Inst.C.E., from the position of Engineer and General Manager of the Brighton and Hove General Gas Company, and his appointment as a member of the Board, it was stated that he has been identified with the Company for the last fifty-four years. Articled to the late Mr. J. Birch Paddon, M.Inst.C.E., in January, 1862, Mr. Cash served for four years, and then entered the service of the Brighton and Hove Gas Company, and soon after was appointed Assistant-Engineer. During this period, the works of the Company were transferred from Hove to Portslade, and Nos. 1 and 2 sections were constructed. In 1882, the Company amalgamated with the old Brighton Gas Company. On Jan. 1, 1886, Mr. Cash succeeded Mr. Paddon as Engineer and General Manager. Various extensions followed, and No. 3 section at Portslade was erected. Later on, carburetted water-gas plant was installed, followed by stoking machinery in the retort-house and coke-conveyors and coke-handling plant. During this latter period, the sale of gas has more than doubled, in face of the severe competition of the electric undertakings of the Brighton Corporation and the late Hove Electric Company, recently taken over by the Hove Corporation. The price of gas in 1886 was 3s. 6d. per 1000 cubic feet; and it was gradually reduced to 2s. 8d., until in April last, owing to the war, the price had to be increased to 2s. 11d. per 1000 cubic feet. The price now charged is, however, a moderate one, when the cost of coal, &c., on the South Coast is taken into consideration.

OBITUARY.

RICHARD FREEMAN.

It is with sorrow that we have to announce the death, last Tuesday night, owing to heart failure, of an old member of the editorial staff of the "Journal"—Mr. Richard Freeman. He had been directly on the staff since 1879; and before that was indirectly associated with it, and so was frequently brought into contact with Mr. Thomas G. Barlow and Mr. William Boughton King, the succeeding first two Editors of the "Journal," and long-time colleagues in the work associated with it. Mr. Freeman was not known generally to members of the British gas profession; but callers at the office often met him, and respected him (as did his colleagues), both for his own personal qualities and for the extraordinary capacity that he had for remembering dates and circumstances connected with the progress and ever-changing phases of the gas industry. He was well known to many of the members of the Société Technique, whose meetings he attended (prior to the last two or three) as the representative of the "Journal." He was an excellent French scholar, and well read in, and a very capable translator of technical subjects from, the French language. One of the delights, through his literary work, was the constant friendly communication which was developed between him and certain French gas engineers. Mr. Freeman was advancing in age; being in his 78th year at the time of his death. Although for a few months, owing to not being in health equal to the exertion, he had not done much work, prior to that he had been most regular in the performance of his duties. For some years he had turned a deaf ear to the suggestions of his friends that he should relinquish work; but he was restless and not particularly happy when away from his old surroundings and duties. So he, of his own choice, continued with us almost to the end; and we shall greatly miss him. In all truthfulness, we can at the end write of him: "Well done, good and faithful servant."

Included in the long list of casualties announced last week was the name of Second-Lieutenant A. G. H. Livesey, of the 3rd battalion (attached to the 1st battalion) of the Royal North Lancs Regiment, who was killed in action in France on Sept. 26-27. Lieutenant Livesey received his Commission on Oct. 4, 1914. He was the younger son of the late Mr. Frank Livesey, M.Inst.C.E., and nephew of the late Sir George Livesey.

Second-Lieutenant E. W. Blenkinsop, second son of Mr. H. W. Blenkinsop, the Under Sheriff for Warwickshire, has been killed at the Front. When the war broke out Lieutenant Blenkinsop enlisted as a private in the Royal Fusiliers, and was later given a commission in the Royal Welsh Fusiliers, from which regiment he was transferred to the 2nd Royal Warwicks. Lieutenant Blenkinsop was articled to Mr. Thomas Berridge, a Director and the Consulting Engineer to the Leamington and Warwick Gas Companies, with whom he remained four years. On leaving, he became Assistant Manager at the Warwick works, with every prospect of a successful career.

GAS-FIRES AND VENTILATION.

The contribution made by Mr. H. James Yates, of Birmingham, to the debate on "Smoke Prevention" at the meeting last month of the British Association, which was reproduced *in extenso* in the "Journal" for Sept. 14 [p. 586], has now been printed in pamphlet form, together with a series of diagrams which are very helpful in studying what Mr. Yates had to say. We therefore give the diagrams now, and refer readers for the text of the communication to the issue named.

Diagrams of the Comparative Ventilation of an "Injector-Ventilating" Gas-Fire, an Ordinary Gas-Fire, and a Coal-Fire.

[Note.—Extra CO_2 was added to the air of the room, which was then mixed and analyzed—sample headed X. After the lapse of a definite period, during which the fire was ventilating, three series of samples were taken.]

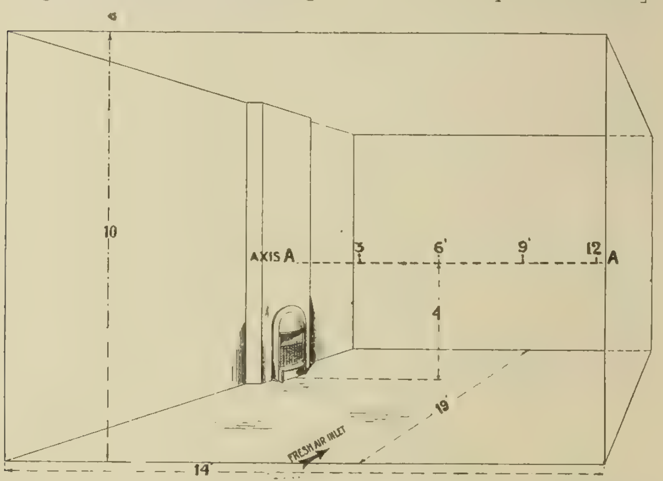

Fig. 1. Series 1.—Samples taken simultaneously along Axis A, at right angles to the Fire, and 4 feet from the Floor, at 3 feet, 6 feet, 9 feet, and 12 feet from the Fire.

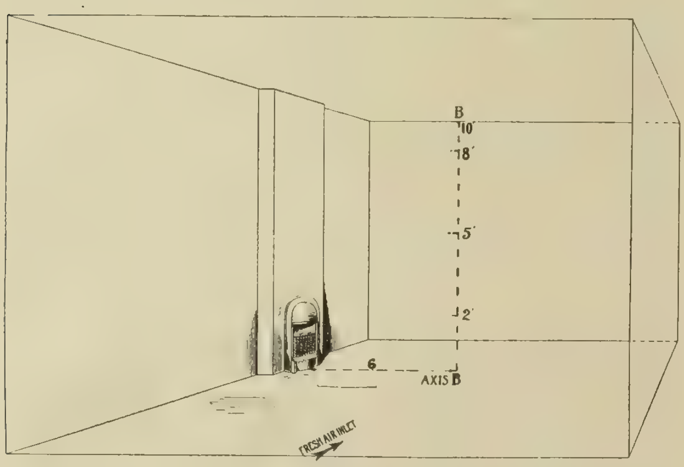

Fig. 2. Series 2.—Samples taken simultaneously along Axis B, and 6 feet from the Fire, at 2 feet, 5 feet, 8 feet, and 10 feet from the Floor.

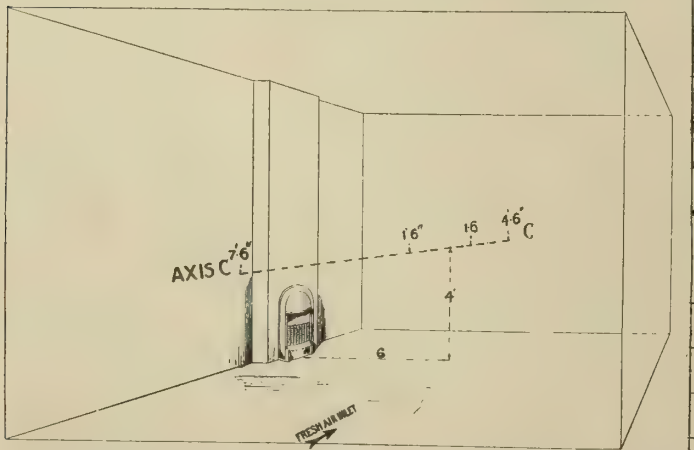

Fig. 3. Series 3.—Samples taken simultaneously along Axis C, 4 feet from the Floor, and parallel to the Fire, at 1 ft. 6 in. and 4 ft. 6 in. on the Right of Axis A, and 1 ft. 6 in. and 7 ft. 6 in. on the Left of Axis A.

[Notes to figs. 4, 5, and 6.—The squares are 1 foot each way. The area enclosed by the dotted line (· · · ·) corresponds approximately to that ventilated by the ordinary gas-fire; the area enclosed by the line of crosses (X X X) to that ventilated by the "Injector-Ventilating" gas-fire; and that enclosed by the line of dashes (— — —) to that ventilated by the coal-fire. The figures for the CO_2 denote the amount to which it was reduced in a given time and not the ultimate figure to which it would be reduced if ventilation were allowed to proceed until the CO_2 became constant. The figures outside the squares refer to the distances from the fire, as shown in figs. 1, 2, and 3. The figures along the axes refer to the analysis, as given in explanatory note—the upper line of figures in each group referring to the coal-fire, the central line to the "Injector-Ventilating" gas-fire, and the bottom line to the ordinary gas-fire.]

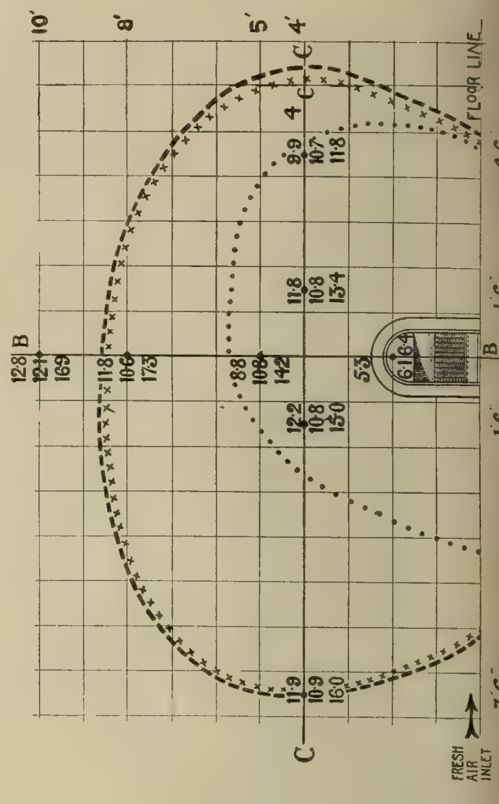

Fig. 6.—Sectional Elevation along Axes B and C (figs. 2 and 3), showing the Approximate Area ventilated along these Axes.

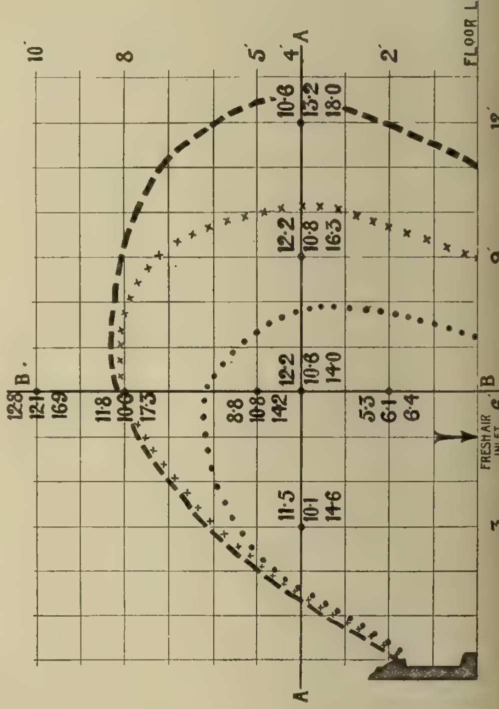

Fig. 5.—Sectional Elevation along Axes A and B (figs. 1 and 2), showing the Approximate Area ventilated along these Axes.

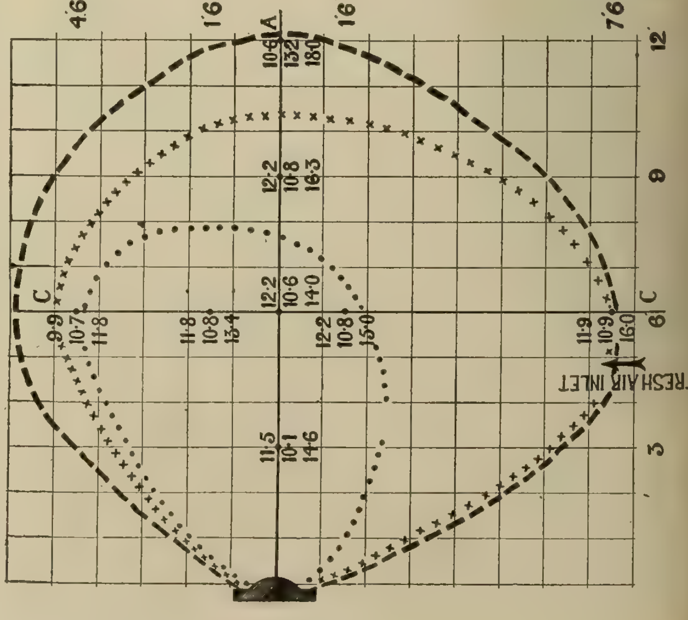

Fig. 4.—Sectional Plan along the Axes A and C (figs. 1 and 3), showing the Approximate Area ventilated along these Axes.

Tabulation of Results.

Parts of CO_2 per 10,000 *in Figs.* 4 *and* 5.

	X	3-Inch.	6-Inch.	9-Inch.	12-Inch.
"Injector-Ventilating" fire	15·0	10·1	10·6	10·8	13·2
Ordinary gas-fire . . .	18·0	14·6	14·0	16·3	18·0
Coal-fire	15·0	11·5	12·2	12·2	10·6

Parts of CO_2 per 10,000 *in Figs.* 5 *and* 6.

	X	2-Inch.	5-Inch.	8-Inch.	10-Inch.
"Injector-Ventilating" fire	15·0	6·1	10·8	10·6	12·1
Ordinary gas-fire . . .	18·0	6·4	14·2	17·3	16·9
Coal-fire	15·0	5·3	8·8	11·8	12·8

Parts of CO_2 per 10,000 *in Figs.* 4 *and* 6.

	X	7 ft. 6 in. Left	1 ft. 6 in. Left	1 ft. 6 in. Right	4 ft. 6 in. Right
		of Axis A.			
"Injector-Ventilating" fire	15·0	10·9	10·8	10·8	10·7
Ordinary gas-fire. . . .	18·0	16·0	15·0	13·4	11·8
Coal-fire	15·0	11·9	12·2	11·8	9·9

LOW TEMPERATURE CARBONIZATION.

The Rollason Process.

The numbers of the "JOURNAL" for Sept. 21 and 28 contained references [pp. 635, 696] to the Rollason process for the treatment of coal; and, under the above heading, the "Iron and Coal Trades' Review" for the 1st inst. made the following reference to the matter.

There is certainly nothing new in low-temperature carbonization; and, in the light of past experience, one is disposed to regard somewhat sceptically the commercial possibilities of any such process. Hitherto in the process only the highest quality of coking coal has been used—mainly to permit of the residue being recovered in the form of a fuel which will stand handling and transport. With these coking coals, however, owing in many instances to the low ash content, the gases cannot be evolved at a low temperature, or a coke be produced of sufficient hardness. It is therefore necessary to raise the temperature so high that the hydrocarbon vapours evolved are split-up into methane and hydrogen—leaving most of the carbon in the amorphous form, causing the coke to be soft and friable. The yield of oils is, therefore, low compared to the volume of hydrocarbons contained in the coal.

We may assume that in all systems of low-temperature carbonization hitherto, the coal is carbonized at a temperature of approximately 450° C. A ton of coking coal of average quality carbonized by this process would yield 12 to 18 gallons of tar oils, 20 to 25 lbs. of sulphate of ammonia, and approximately 2½ gallons of benzol from washing the gases—leaving about 70 per cent. residue in the form of a soft, friable coke, for which it is difficult to find a profitable market.

No serious attempts have hitherto been made to utilize in the low-temperature system non-coking and semi-coking coals for the production of oils, many qualities of which contain a high percentage of volatile matter. It is in this connection that the patented system evolved by Mr. A. Rollason, whose experimental plant at Pye Bridge was recently inspected by our representative, will prove of particular interest to colliery owners who in normal times have sometimes difficulty in disposing of their small coal. The primary object of the new process is the production from non-coking and semi-coking coals of a large volume of light hydrocarbon oils, free from tar, acids, or sulphur compounds, and, as a secondary consideration, the formation of a residue suitable for conversion into a high-class, free-burning, smokeless briquette. To achieve this, a finely-ground limestone is mixed with the crushed coal before it is fed into the retort. The essential difference between the Rollason and other systems of low-temperature carbonization lies in the employment of this limestone, and the catalytic action set up thereby. Only a small percentage of limestone is used—the amount varying somewhat according to the nature of the oils it is desired to produce.

The limestone serves a dual purpose in the retort: (1) It takes up the heat and decomposes at a low temperature when in contact with coal having a high oxygen content; (2) on the decomposition of the limestone, the calcium oxide is freed from its neutralizing agent, carbon dioxide, and, being now in a nascent condition and chemically active, attacks and (assisted by the heat of carbonization) decomposes the organic matters and bases contained in the coal—thus liberating the gases at a low temperature, usually below, but never exceeding, 450° C. The calcium by its catalytic agency assists in the combination of oxygen and hydrogen, forming water, and carbon and hydrogen, forming hydrocarbons. The water vapour thus formed acts as a carrier for the hydrocarbons, and prevents their decomposition into gases while in the retort. After these vapours leave the retort, they are condensed into water and crude light oils, which, as previously stated, are free from tar, acids, and sulphur compounds.

It should be particularly noted that, in the system under consideration, the water is liberated separately from the hydrocarbon vapours during carbonization, and at a temperature sufficiently low to prevent these condensable vapours from being split-up into incondensable gases; whereas in the ordinary methods of low-temperature carbonization the water comes over mixed with oils, and they are somewhat difficult to separate.

Approximate results are seldom very convincing; but the results actually obtained with coal from the main seam at Askern Colliery, Doncaster, are certainly interesting. The coal, as received from the colliery, gave the following analysis: Volatile matter, 32·2 per cent.; ash, 4·10 per cent.; sulphur, 1·17 per cent.; nitrogen, 1·34 per cent.; fixed carbon, &c., 61·19 per cent. The carbonization of a ton of this fuel yielded 21½ gallons of crude light oils, suitable for conversion into motor spirit, which upon treatment produced 15 gallons of refined spirit. The residue after distillation, amounting to 14 cwt., with 5 per cent. of fine coal added, is in a condition for conversion into hard briquettes. Briquettes made from this residue have a good appearance, are hard, and are said to stand up well in the fire and to be practically smokeless.

The total cost of carbonization, refining, and conversion of the oils into motor spirit, and briquetting the residue, is approximately 6s. 8d. per ton of coal, compared with a total cost of about 4s. 6d. per ton of coal carbonized by the usual low-temperature process. In considering this cost, it must not be overlooked that the new process employs a lower-grade coal, and, apart from the increased yield of oils, provides for the manufacture of the residue into a fuel for which there is an ever-growing market.

The use of a catalytic, however, is not confined to low-temperature systems. It has already been employed with a considerable measure of success at gas-works, resulting, according to report, in an increased quantity of gas of a higher calorific value per ton of coal, a sensible decrease in the quantity of sulphur compounds, less deposit of naphthalene in the services, less deposit of graphitic carbon on the sides of the retorts, a much more liquid tar, containing a greater quantity of the higher aromatic hydrocarbons, a sensible increase in the quantity of ammonia, while the toluene recovered after washing the gases was increased fourfold, and, finally, there was a material increase in the percentage of large coke, and an all-round improvement in the quality.

Our readers, however, will be more directly interested in the use of the catalytic in connection with the bye-product coke-oven, to which the advantages claimed when carbonizing non-coking fuels are equally applicable. It is, of course, merely a question of the size of the retort. In the first place a lower temperature can be used for carbonization, resulting in an increased yield of ammonia and benzols, and an improved quality of tar. A corresponding increase in the large saleable coke is also claimed to result. Not the least important claim is that the destruction of the oven linings is prevented, owing to the surplus oxygen being used up by combination with a portion of the hydrogen before the iron sulphide is decomposed—thus preventing the formation of sulphurous acid, which combines with the sodium chloride in the presence of manganese contained in the coal, forming hydrochloric acid, which attacks and decomposes the iron contained in the fire-brick.

This temperature system of low carbonization is being exploited by the Basic Carbonizing Syndicate, Limited, and the other applications of the catalytic by the Synthetic Gas Processes Company, both of Nottingham.

As already mentioned, the experimental retort is at Pye Bridge. This, however, calls for little special description. The retort, which has a holding capacity of 8 cwt., consists of a cylindrical receptacle surrounded by brickwork. A bunsen burner is placed beneath the retort; and the products of combustion circulate around and between it and the chamber walls. The outlet is formed of a coiled pipe in which condensation takes place, and which terminates in the oil-tank. From this last the oil and water are separated out.

London and Southern District Junior Gas Association.

The programme of the Association for the forthcoming session (a copy of which is to hand from the Hon. Secretary, Mr. George Winslow) is as follows:—

Oct. 22.—Address by the President (Mr. S. B. Chandler, of the South Suburban Gas Company).
Nov. 12.—Paper by Mr. Hartley (of Richmonds, Limited), on "Development of Gas-Fires, 1913-15."
Nov. 26.—Paper by Mr. B. W. Brooks (of the Gas Light and Coke Company), on "Gas-Furnaces."
Dec. 4.—Visit to Industrial Appliance Show-Rooms and Demonstration Workshops of the Gas Light and Coke Company, Goswell Road.
Dec. 10.—Paper by Mr. W. L. Westbrook, on the "Gas-Cooker *versus* Coal Range for Domestic Purposes."

1916.

Jan. 28.—Paper by Mr. E. Stroud (of Holophane Limited), on "Modern Illumination as Applied to Gas Lighting."
Feb. 5.—Visit to the Works of the Wandsworth Gas Company.
Feb. 25.—Paper by Mr. Arthur R. Griggs, on "The Microscopic Examination of Metals: Its Application to Gas-Works Engineering."
March 12.—Visit to the Works of the South Suburban Gas Company.
March 25.—Paper by Mr. E. W. L. Nicol (of the London Coke Committee), entitled "Coke as a Fuel for Steam-Motors, &c."
April 9.—Visit to the Works of the Tottenham Light, Heat, and Power Company.
April 29.—Lantern Slide Meeting of Technical Interest by Mr. J. G. Clark.
May 13.—Annual General Business Meeting.
June 18.—Summer Meeting. Visit to the Works of the Hampton Court Gas Company.

COAL AND COKE CONVEYING PLANT AT THE OBUDA GAS-WORKS, BUDAPEST.

By Herr Viktor Schön, the Deputy-Manager of the Budapest Gas-Works.

A general description of the new Obuda Gas-Works at Budapest, taken from an account published by Herr I. Bernauer, the Manager of the works, was given in the "Journal" recently [Vol. CXXXI., pp. 21, 77, 125, 181]. A detailed account of the coal and coke conveying plant was given by Herr Viktor Schön, the Deputy Technical Manager, at the thirty-third annual meeting of Gas and Water Engineers of Austria-Hungary, and has been published in the "Journal für Gasbeleuchtung" for Aug. 14, 21, and 28. The following is a summary of Herr Schön's paper.

General Requirements.

The guiding principle in the scheme of the whole plant, as well as in designing particular parts of it, was that the plant should provide a simple and rational equipment which would be economical in working and would adapt itself to the subsequent extension of the gas-works. The conditions which the plant had to fulfil may be set out as follows.

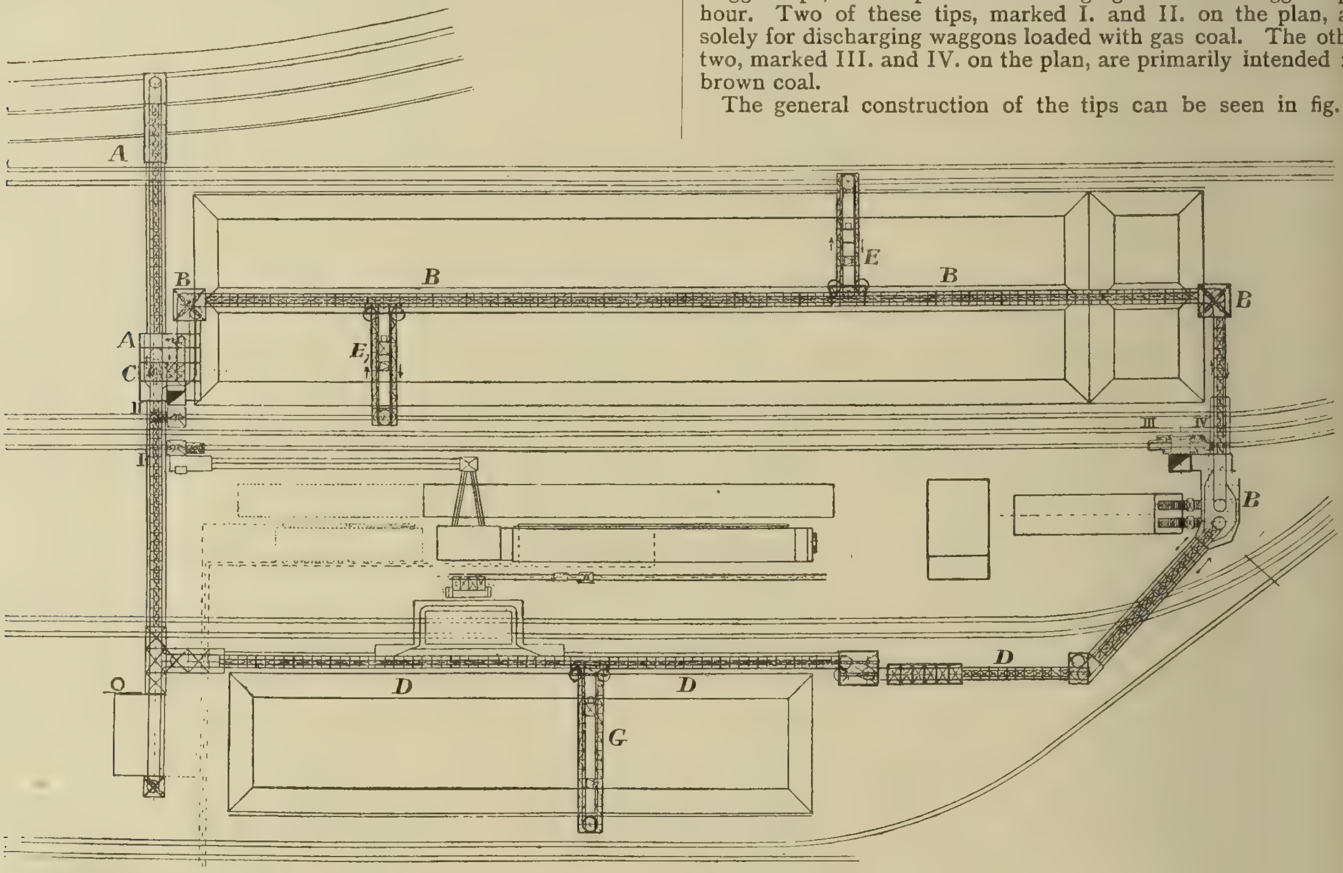

FIG. 1.

The coal conveying plant was required: 1.—To convey coal arriving in waggons to (*a*) the storage bunker of the carbonizing plant, and (*b*) the coal storage yard. 2.—To convey brown coal or lignite arriving in waggons to (*a*) the storage bunker of the producer plant, (*b*) the storage yard, (*c*) the storage bunker of the boiler plant. 3.—To pick up gas coal and brown coal from the storage yard and convey them into one of the three storage bunkers already named. 4.—To pick up coal arriving by water and convey it into the storage bunker of the carbonizing plant or to the coal storage yard.

The coke-conveying plant was required: 1.—To convey the coke discharged from the carbonizing chambers to the coke-breakers, and thence to the sorting plant. 2.—To convey the sorted coke (*a*) to the coke storage yard, (*b*) direct into railway waggons, (*c*) to the bunker for retailing, (*d*) to the storage bunker of the producer plant, (*e*) to the storage bunker of the boiler house, (*f*) to barges on the Danube Quay; also to pick up coke from the storage yard and convey it to the points named under (*b*) to (*f*).

The coal-conveying and coke-conveying plants were therefore required for nine to twelve works' operations. All these have been provided for except the conveying of coal from ships. This is a source of supply which will not be brought into use at present. The central operating station and the overhead line leading to the Danube Quay have, however, been made large enough to admit of grabs being later introduced on the quay without difficulty.

Before proceeding to describe the arrangements adopted, it may be mentioned that it was ascertained, from a study of the matter and calculations, that the coal and coke conveying plant would have to be equal to a daily productive capacity of 14,125,000 cubic feet of gas, although the carbonizing plant itself was for the time being constructed for a daily capacity of only 9,535,000 cubic feet. For the production of the former quantity of gas, about 1200 tons of coal are required, which would yield 840 tons of coke. For heating the settings there would be required daily about 200 tons of brown coal or lignite; making, with a further quantity of 50 tons used under the boilers, a total of 250 tons of brown coal. In determining the size of the coal-conveying plant, attention had, however, to be given to the fact that the coal does not arrive by rail at a uniform rate, but occasionally two or three times as much on one day as on other days; and this must be dealt with without interruption.

COAL CONVEYING PLANT.

Discharging the Coal-Waggons.

The loaded waggons are drawn up on arrival as complete trains on the middle of the three tracks alongside the west side of the coal storage yard. The waggons are then brought separately, by means of a rope shunting installation and two sets of points, to the waggon-tips constructed on the first and third tracks. In the plan given in fig. 1, the three tracks are shown, but the switches are outside the plan to the left. There are altogether four waggon-tips, each capable of discharging ten 20-ton waggons per hour. Two of these tips, marked I. and II. on the plan, are solely for discharging waggons loaded with gas coal. The other two, marked III. and IV. on the plan, are primarily intended for brown coal.

The general construction of the tips can be seen in fig. 2. They are anchored at one end to the foundation, and the other end is raised or lowered by means of a pair of rollers. The pair of rollers is moved by a strong Gall's chain by an electromotor of 30 h.p. The track or travel of the rollers is so arranged that the waggon is raised only slowly at first; and the rate increases as the vertical through the centre of gravity of the waggon approaches the turning point. The tips are operated from control boxes partly below the ground level at the side of the tracks. The waggons are kept in place by two powerful hooks, which are attached to the front axle. The waggon bodies also are held down by a chain. The construction is so simple that the cost was relatively small. Further, the cost of the foundations was much less than with the older types of waggon tips. At both discharging points there are two tips facing in opposite directions; so that waggons having a brakesman's box at one end (as is common with Continental waggons) can be discharged without having to be turned round. The two waggon-tips alongside the producer plant are both on the same track facing one another; but the two adjoining the central operating station are on separate tracks.

Direct Supply of the Carbonizing Plant with Coal.

A coal-bunker, in reinforced concrete, is provided, capable of containing the 1200 tons for a full day's requirements. Charging waggons, driven electrically on rails passing underneath this bunker, are charged from it, as described in Herr Bernauer's article already referred to. The bunker is filled in the following manner: In front of each of the waggon-tips Nos. I. and II. a wrought-iron bunker is constructed beneath the tracks, and the

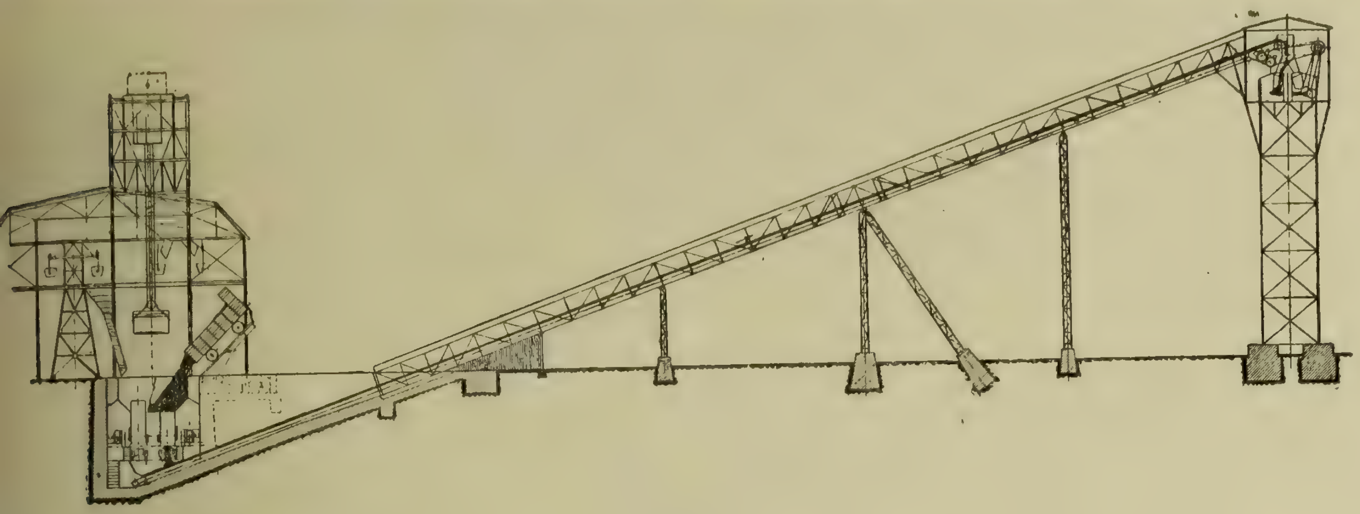

FIG. 2.

oal is shot from the waggons into it. Each of these bunkers as two outlets, with sliding valves, through which the coal passes nto the "Seltner" coal-breakers, each of 60 tons per hour capaity, placed below the bunkers, as shown in figs. 2 and 3.

The coal-breaking plant is provided with mechanical receiving rids. The large coal which does not pass through the grids is elivered to the breakers; while the smaller coal misses the latter nd falls direct on to the band conveyor. Each pair of breakers, behind the other, delivers the coal, when broken to the size f the fist, on to a rubber band conveyor (shown in figs. 2 and 3) unning underneath, which is driven by a 16 H.P. motor. The reakers are encased by sheet iron. The pits in which they are laced have two large extraction pipes, by which the dust is rawn away. The breakers are of the roller type, each having wo rollers with blades and a fixed bladed harrow.

The rubber conveying bands running underneath the breakers re 32 inches wide, and each has a capacity of 120 tons per hour. hey are mounted on a wheeled framing, by which they can. e shifted longitudinally, so that a 3 H.P. motor will drive both hus either of the two bands can deliver the coal on to either of he two elevating conveyors shown in fig. 2. Adequate provision as been made for removing the dust from the underground reaker chambers. The coal delivered from the band conveyors alls through funnels on to one of the two bands, which rise at an ngle of 18°. These convey it to the corner station, where it is elivered by them on to one of two transverse bands.

The band elevators are inside a covered gangway with iron raming, roofed with sheets of "Eternite," and with roof lights. t the corner station at the top of the incline is a 40 H.P. electronotor, which drives both the elevating bands and the transverse ands at the top of the incline. The coal falls from the transerse bands into the bunkers through discharging waggons which re constantly moving to and fro—see fig. 4. All the equipment s provided in duplicate, and with portions of each set interchangeable; so that interruption of working may be regarded as out of the question. The 1200-ton coal-bunker can be filled in ten hours.

STORAGE OF COAL.

The storage of gas coal which is not required directly at the settings takes place in the following way: Alongside each of the two waggon-tip stations there is a deep pit, into which the coal drops as it is tipped from the waggons. The No. I. tip is not intended for the storage of coal, but only for the supply of the carbonizing plant. If coal is to be stored from the No. II. tip, the slides shown in figs. 2 and 3 are closed, and the sliding door leading to the grab-pit is opened. The waggon-tips Nos. III. and IV. discharge on an inclined plane, on which the coal slides down to the grab-pit, shown in fig. 5. Above each of the grab-pits is a framing, 72 feet high, on which runs the travelling carriage, or crab, of an automatic grab. This grab, having a capacity of 4·25 cubic yards, raises the coal above the level of the top edge of the bunker. The travelling carriage then runs over the latter and the grab opens and discharges its contents into the bunker. Each of the two grab installations deals with 100 tons per hour. The travelling carriage or cab has a driver's platform and a 60 H.P. winding motor, as well as a 15 H.P. travelling motor. The rate at which the grab is raised is 115 feet per minute, and the rate of travel horizontally is 295 feet. From the bunkers just mentioned the coal transporter waggons, of 1·6 cubic yards capacity, running on fixed rails, are filled with coal, and pushed by hand to the coupling place, where they are automatically coupled to the rope by which they are drawn on.

It is well known that the transport of heavy materials is most effectively carried out by means of a transporter system, as the tracks readily pass round any obstacles, whether in a horizontal or vertical direction. Since the cost of the bearers or supporting framework is comparatively small, the length of the line is not of great moment. The storage yard could thus be a long way from the place at which the coal would be consumed, and the space under the track could be made use of for other purposes. In the case of the Obuda works, the laying out of the tracks was a very simple matter, owing to the local conditions; and the different tracks, as can be seen from the plan (fig. 1), could be all joined to a closed circuit. The tracks used for the storage of the coal are those marked B B on the plan, extending from the central power station to the producer station, and having a length of about 33,000 feet, in addition to the two bridges E and E¹ over the storage yard.

The driving machinery and the rope-winding apparatus in the

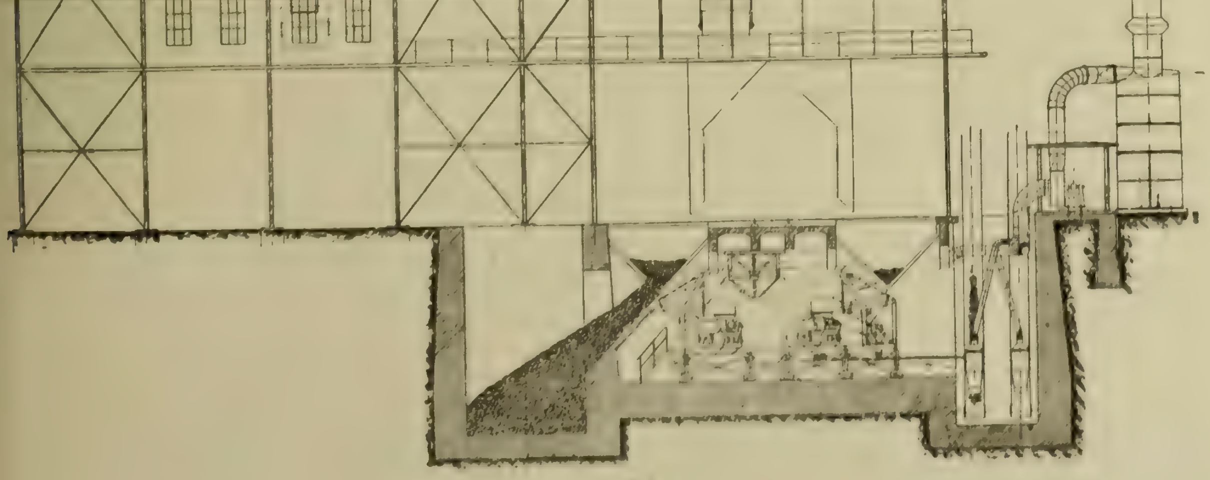

FIG. 3.

central station serve also for the tracks A A, 577·5 feet in length, and C C, 951·5 feet in length, which will be referred to later. For working the three tracks—of which any one can at any time be put out of action—there are two 60 H.P. motors, one of which is kept as a stand-by. The haulage rope, on leaving the central power station, runs over a corner pulley, 13 feet in diameter, and then along the storage yard to the bridge E. It then swerves back again from the bridge on to the girder framing, which divides the coal-store into two halves, passes over the corner pulley on the right at the end of the coal-store to the producer plant, and returns thence to the central girder framework. From the latter it returns over the bridge E^1 to the power station. The rate of travel of the rope is 40 inches per second.

The bridge from which the coal is discharged is moved by electric power, and is in the form of a part-flying crane. It stretches across the whole coal storage yard, and enables the waggons to be discharged at any desired part of the yard by means of deflecting blocks, which can be shifted as required. In the central power station the overhead track B branches off to the right to the coal storage yard, while in front the track C leads to the boiler-house, and at the back there is the track A leading to the Danube Quay. In front of the power station is one of the grab installations, and in the roof of the building are accommodated the intermediate bunkers from which the waggons are filled.

Picking up the Coal from the Storage Yard.

For picking up the stored coal there are two grabs, which travel on the bridges over the storage yard and have each a capacity of 60 tons per hour. By means of the grabs the coal can be picked up from any part of the storage yard, and, through the intermediate bunkers in the middle of the bridges, can be put into the transporter waggons. The filled waggons are then coupled to the rope which draws them to their destination.

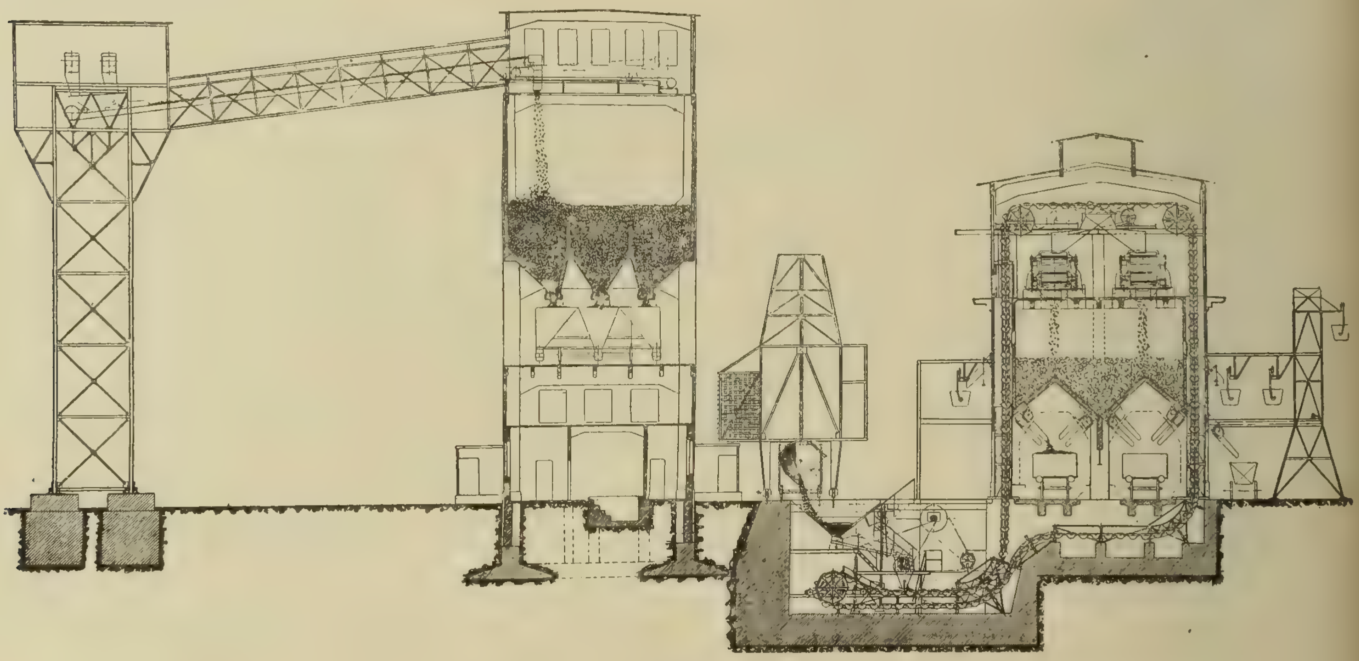

FIG. 4.

Supply of the Carbonizing Plant with Coal, and of the Producers and Boiler Plant with Lignite.

The direct supply of the carbonizing plant with coal which has just arrived has already been referred to, and it only remains to explain that, when coal which has been in store is used, the transporter waggons filled with it from one of the two bridges over the storage yard are shunted at the central station from the track B to the track C. On the latter they are discharged into a funnel, through which the coal falls into the bunker above the coal-breakers, and, after passing through the breakers, it is taken, in the manner already described, by conveying bands to the coal-tower of the carbonizing plant.

The bunkers of the producer plant are filled by means of a conveyor which is fed by a bunker, shown in the plan (fig. 1), into which the transporter waggons, filled with brown coal by the grab or else on one of the bridges E or E^1, are discharged. The boiler-house is supplied by bringing the waggons filled with brown coal at one of the places just named to the central station, and there passing them on to the track C, which leads over the bunkers of the boiler-house into which the transporter waggons are discharged. It should be mentioned that the transporter plant has been designed for a capacity of 200 tons per hour, and that automatic weighing machines have been introduced at suitable places on the track, in order to determine the quantity of coal used in different parts of the works.

The transporter waggons are fitted with a crank lever which is pressed back by the tongues which serve for discharging the coal. The waggons, being suspended eccentrically, are tipped and thereby emptied. The central power station is at the back of the whole installation, together with the grab, in front of which is the bridge E^1 on the storage yard. Issuing from the front of the power station is the crane track constructed as a fixed bridge and carrying the running tracks for the waggons. On the right is the second bridge over the storage yard, and in front of it the southern corner station from which the transporter track leads to the left to the producer plant. In front of the latter is the filling funnel for the two conveyors, as well as the framing which supports the latter. To the right of the producer plant is the grab station and one of the waggon-tips. The coke conveying plant is to the left of the producer installation. The whole installation has been designed so that the most diverse combinations of the work of the different operating sections are possible. The transporter waggons travel at the rate of 40 inches per second, at distances apart of 56 feet.

COKE CONVEYING PLANT.

Conveying to Breakers and Sorting Plant.

The coke, as expelled from the carbonizing chambers by the machinery, falls through the coke-quenching chamber in front of the settings into the quenching waggon, which travels below the latter, and is there quenched with water. The coke-quenching waggon, driven by electricity, then travel over the bunker constructed in front of the breaking and sorting plant, and discharge their contents into it. The quenching waggon holds about 7 tons of coke. The emptied waggon then returns to the next chamber in order to receive the charge from it. The coke-breakers are beneath the bunker, and discharge on to a conveyor which runs below them. This conveyor raises the coke above the sorting plant.

Each of the two coke-breakers has a capacity of 30 tons per hour, and is of similar construction to the coal-breakers already described. Each conveyor has a capacity of 60 tons per hour. One set of plant suffices for present requirements, and the second serves as a stand-by. The arrangement of the bunker, and breaking and sorting plant is shown in fig. 4. The delivery shoots from the bunker to the coke-breakers are kept in constant movement, in order to prevent the bunker outlets from becoming blocked; and they have rocking screens through which coke breeze falls and reaches the conveyor without passing through the breakers.

There are four sorting plants, each of 30 tons per hour capacity. In place of the usual swing grids the sorting plants have circular riddles, slightly inclined, and given a circular movement by an eccentric. Different shoots deliver the sorted coke into separate bunkers below them. The apparatus divides the coke into four classes—viz.: (1) Large coke exceeding 2 inches; (2) nuts from $\frac{4}{5}$ inch to 2 inches; (3) hazel nuts from $\frac{1}{3}$ to $\frac{4}{5}$ inch; and (3) breeze less than $\frac{1}{3}$ inch in size. The sorted coke is drawn off from the different bunkers through shoots, either into transporter waggons, in which it is taken to the places where it is required for use, or it is conveyed to the storage yard. Beneath the building containing the sorting plant two railway lines pass, on which waggons, moved by the rope-shunting installation, can be filled from shoots in the bottom of the bunkers. In these lines there are four weighing machines for loads up to 30 tons; and the waggons are here made up into trains which are drawn by a locomotive to the works' railway station. On the side of the building facing the coke yard there are other shoots which are used for filling carts.

Transport of the Sorted Coke.

The coke which is not loaded direct into railway waggons is drawn off into transporter waggons, by which it can be conveyed o either of the following destinations—viz.: (*a*) The bunker of he coke-retailing depôt; (*b*) the bunker of the producer plant;) the bunker of the boiler plant; (*d*) the loading quay on the oreshore of the Danube; and (*e*) the coke-storage yard. For hese purposes another transporter track, about 2795 feet in length, narked on the plan (fig. 1) as D D D, has been provided. It is rought into communication, through appropriate switches, with oth the transporter track B and the track C. Communication vith the track B is provided in case there should be a breaklown on either track, in which case their functions could be eversed. The connection with the track C admits of the transorter waggons passing to the boiler-house, or through the central ower station on track A to the Danube Quay. In both cases he switches are hand controlled.

In the power station there is a 20 H.P. motor, used for this track only and the rope-winding apparatus. The haulage rope extends rom here, along the framing which supports the transporter rails, up to the bridge G which extends over the whole storage yard. The framing supporting the transporter rails also serves as a ravelling track for this bridge, which is in the form of a partflying crane. From the bridge the haulage rope turns round and passes through the coke retailing depôt to the producer plant, where it runs round a terminal pulley on the crane-track supports, and so back to the power station. In front of the cokesorting house, both the rope and the transporter rails are brought to a low level, in order to reduce the height of the building. The transporter waggons, filled under the two longer sides of the building, are shifted by hand on to the coupling station, where they are coupled automatically to the haulage rope, and are then hauled to the power station, where they are automatically released from the rope. They are then transferred by hand to the track leading to their destination—viz., the track C if they are to go to the boiler house, the track A if they are to go to the Danube and back to the track D if the coke is to be discharged in the coke-storage yard, in the bunker of the retailing depôt, or at the producer plant. The waggons, which are tipped and emptied by tongues projecting at the required spots, then return to the sorting plant for refilling.

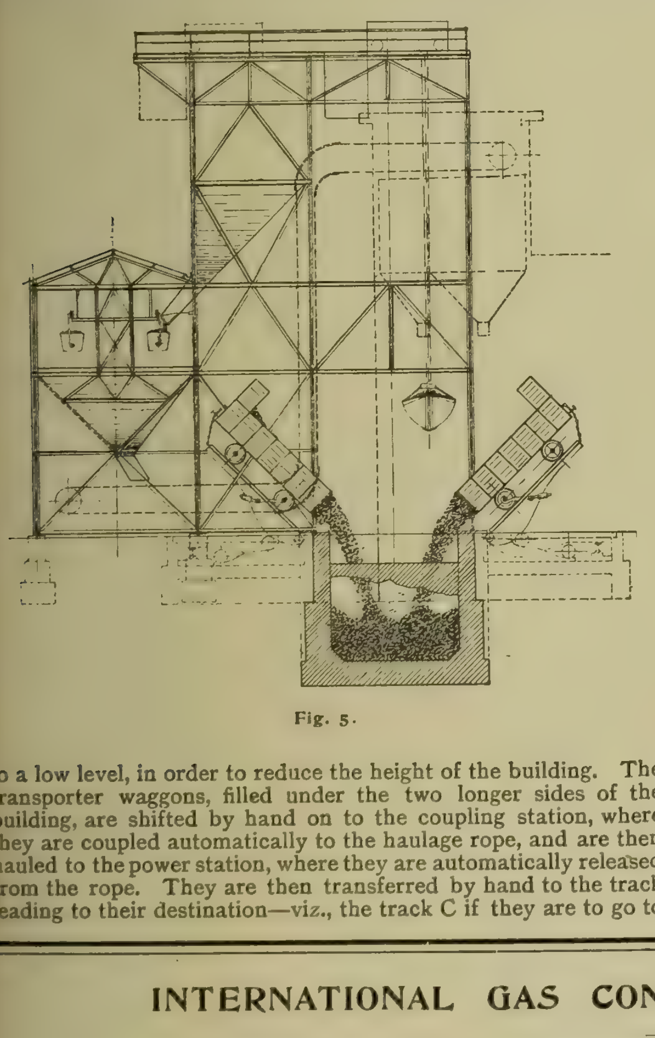

Fig. 5.

TRANSPORT OF COKE FROM STORE TO DIFFERENT DESTINATIONS.

The coke is lifted from the store yard by means of a travelling carriage or cab. In order, however, to avoid damage to it, a grab is not used, but a flap-bottomed skip, filled by hand. This plant, like the rest of the conveying plant, has a capacity of 60 tons per hour. The crane bridge over the coke yard is moved by a 20 H.P. motor at a speed of 40 feet per minute. The hoisting motor of the crab is of 30 H.P. and hoists the skip at a speed of 141 feet per minute; while the travelling motor is of 10 H.P., and gives a speed of travel of 492 feet per minute. The filled skips are elevated by the crab and brought over the filling bunker on the bridge. They are then opened like the grabs, and their contents discharged into the bunker. The transporter waggons filled from this bunker are coupled automatically to the rope and sent to their destination in the manner already described. A slide, which can be shifted lengthwise along the bridge to the place where coke is being shot in the storage yard, serves as a gauge to prevent it being piled to too great a height. To the right is the filling bunker with a platform beneath it, on which the two men in charge of the filling operations stand. Both to the right and left of the bunker are arranged the automatic coupling and uncoupling arrangements.

In front of the shoots of the coke retailing depôt there are six automatic weighing machines, by means of which carts can be loaded with exactly the desired weights of coke. At the other side of the depôt there are ordinary shoots, and the carts filled from them are weighed on a weighbridge at the gate. In the bottom of the bunker there are other shoots which are used for filling sacks with coke.

CONCLUSION.

The coal and coke conveying and handling plant was supplied by various German and Hungarian firms. The coal-breaking plant and band conveyors attached to the carbonizing plant cost about £18,750, exclusive of the coal-bunkers. The rest of the coal and coke conveying plant cost about £62,500. The coke breaking and sorting plant, including the reinforced concrete building, cost about £21,667. The contracts were placed at the end of the year 1911 and the beginning of 1912, and work upon the foundations started in the spring of 1912. Notwithstanding delay in the delivery of the structural steel, the work was completed in time for the gas-works to start operations on Oct. 16, 1913. As regards operating expenses, the following figures are given:

(1) For tipping a 20-ton waggon, two men and 0·46 unit of current (alternating, 190 volts, 50 periods) are required; so that the cost of discharging a waggon is 2·1d., or about 0·1d. per ton. With smaller waggons the cost per ton is correspondingly increased.

(2) Breaking the coal and conveying it to the coal-bunkers of the carbonizing plant at a height of 82 feet requires three men and 36 kilowatts per hour. The cost works out at 0·43d. per ton.

(3) The putting of the coal into store costs 0·9d. per ton, and eleven men are required for the work. The picking-up of the coal from the store-yard and conveying it to the place where it is required for use costs the same. Thirteen men are, however, required on this work; while the consumption of current is rather lower.

INTERNATIONAL GAS CONGRESS AT SAN FRANCISCO.

Opening Address of Dr. Alex. C. Humphreys, the President—Delivered Tuesday, Sept. 28.

As the representative of the gas societies of the United States, it is now my duty to declare that the International Gas Congress of the Panama-Pacific International Exposition is in session.

It is my privilege first to extend a most sincere and hearty welcome to all in attendance. And I speak for all those I represent, when I say that we of the United States are keenly appreciative of the presence of our brethren from foreign countries. This International Congress of the gas men of the world has come to be limited in some degree through the unhappy conflict which is now raging over the greater part of Europe, while involving Asia, Africa, Australasia, and the Isles of the Pacific. It is most gratifying, in the face of this interference, so grave in character, that this congress as to attendance, and particularly as to contributions of papers, is still of international scope.

THE WORLD WAR.

When the exposition was planned, and even later when the congress was suggested, the man who had ventured to suggest as even a possible interference a war involving all the great powers of Europe would have been pronounced a rank pessimist, if not a madman. But the impossible, as it then appeared, but which with the records even so far disclosed we can now see was inevitable, has come to pass. And thus many of our co-workers from abroad, whom we had hoped to welcome at this time, are now arrayed against each other in what threatens to be a death struggle. In this frightful happening, our sympathy goes out to all who have been innocently dragged into this barbaric war by the acts of others.

Let us, then, first pause to express the hope that out of this world-war—the most shockingly destructive and horrifying within the knowledge of man—there may result finally some measure of compensating good for the peoples as a whole, and particularly greater security for those who are anxious to live at peace with their neighbours and to exercise the right of working-out their own destinies free from outside pressure and interference. Let us at least cherish the hope that the cruel maiming and killing of combatants and non-combatants does not indicate a retreat from the struggle for a higher civilization—a cause to which we, particularly as engineers, are committed. This hope is encouraged as we hear of the many acts of self-sacrifice and heroism on the part of the innocent participants in this bloody struggle. May we not wisely recognize the present-world conditions as a deserved rebuke to that spirit of boastfulness and self-sufficiency which regards all things and ideals of the present as superior to those of the past. For our own safe guidance, we are being reminded that in the administration of this world's affairs, we still have to deal with the same human nature, with all its primitive weaknesses, with which the peoples and governments of the past have had to deal. This is a lesson that we of the United States particularly should take to heart.

With regard to engineering, it is disconcerting to recognize, as we must, that the wonderful advances in science made during the last century have greatly increased the horribleness of war. This being the case, we are, I fear, forced to the conclusion that those who, with consistent and persistent efficiency, avail themselves of the teachings of engineering science to prepare for war, possess a controlling advantage over those who—recognizing, as we all do, the material and spiritual benefits of peace—are content to depend for their protection on the good will and forbearance of those who have the power, if not the avowed purpose, to enforce their wishes, demands, and even their so-called ideals. Those who are unprepared are thus left at the mercy of the prepared.

There are no people of the world better situated geographically than we of the United States to pursue untrammelled our vocations and avocations of peaceful living. But this advantage is only comparative, and does not guarantee to us immunity from war's bondage. "Eternal vigilance is the price of liberty." But knowledge of a threatened peril affords in itself alone no protection from tyranny.

THE PEACEFUL ARTS.

With all the misery surrounding us, it is fortunate that our immediate duty is to devote ourselves for the next few days to the study of the questions involved in one of the peaceful arts—artificial illumination by gas. We are fortunate that we can take up the study of our many problems free from the fear that the product of our knowledge, experience, and energies might be applied to the injury and destruction of our fellows.

With a sense of relief from direct participation in the trials, miseries, and sorrows of our fellows, we must also realize that we are involved through the ties of brotherhood. It is for us to do all that lies in our power to alleviate the distress so much in evidence abroad. When we think of the barbarities which are now chargeable against members of the human family, it is some consolation to reflect upon the noble, self-sacrificing work of relief being done by non-combatants. In this work, the people of the United States have stood out in the front rank; and let us all show by word and deed that we appreciate there is no retreat from this assumed duty until the war and its immediate effects are things of the past.

RESPONSIBILITY OF THE ENGINEERING PROFESSION.

Not only in the direction of charity does there rest upon us a grave responsibility, but also in making preparations, to the limits of our means and powers, to adjust our industries to supply those products which the countries now at war will be unable for some time after peace is declared to create for themselves. This is a responsibility which rests with particular weight upon the members of the engineering professions; for it is upon engineering in its many branches that the industries depend. I say all this in no mercenary spirit; for the more efficiently we are prepared to supply the peoples abroad, the lighter can be made their financial and physical burdens during the period of recuperation.

Notwithstanding the events which overshadow us, we must meet our own direct responsibilities. It is then encouraging that so many of us have been able to meet here, to exchange our views and experiences with respect to that part of the world's work for which we are more specifically responsible. In connection with our discussions, we must not forget that those who have been unable to meet with us are to be given the opportunity to study the records of our sessions. This places upon us all a responsibility which, I am convinced by a long and wide experience, is not sufficiently appreciated by the membership of societies formed for the promotion of specialized study. The transactions of these societies in many cases fail to disclose adequate discussion—thus leaving the questions involved answered incorrectly or unanswered. In our technical meetings too many men sit silent when they have valuable matter to disclose—this sometimes from modesty and sometimes from indifference. Others, on the other hand, are too ready to occupy the floor in presenting irrelevant or misleading discussions. It is the activities of the latter which increase the responsibilities of the former. Let us, then, be diligent and painstaking at this time to develop "the truth, the whole truth, and nothing but the truth."

The foundation for our business is one branch of engineering—a branch which is broad in its scope, involving as it does much which is ordinarily classified as civil, mechanical, mining, chemical, and even electrical engineering. Combine this breadth of scope as to engineering with the complex business and politico-economic questions which present themselves for our solution, and we must realize that we carry our full share of responsibility as citizens and members of the great human family.

MEETING COMPETITION.

So, coming to our immediate work, we have to bear in mind that we have many problems to solve and many difficulties and dangers to meet. In the electric light we have a competitor which has grown stronger year by year. Let us not fail to recognize that this competitor has been guided by financiers, engineers, and business men of the highest attainments. Particularly, has the engineering profession here contributed of its best. Let us not deceive ourselves, therefore, as to the facts; but let us face the facts and so be the better prepared to demonstrate where, when, and how gas can be best and most economically employed. We are told, "Necessity is the mother of invention;" it is also the spur to the most intense and persistent effort. One thing we may certainly agree upon: We cannot afford to neglect any opportunities for betterment which present themselves or can be discovered.

Here in the United States, in common with our electric light competitors, we have other troubles and dangers to meet and overcome. Particularly have we, in common with all the public utilities, to meet the present evil of over-regulation. Perhaps our friends from abroad are in a position to sympathize with us in some degree.

SUPERFICIAL LAW MAKING.

The necessary regulation suggested by changes in methods of living since the time of Jefferson do not call for the placing in the hands of a single department the power to exercise the three functions of government: The legislative, the executive, and the judicial—the three functions which that "most conspicuous apostle of democracy in America," as he has been styled, declared must be kept separate. To this same principle the party now in power most specifically committed itself in the last presidential convention platform. Here in the United States we are all too ready to enact new laws to control, to cure, or to eliminate the old faults, weaknesses, and sins of humanity. Over 60,000 new laws put upon our Federal and State statute books in five years necessarily mean superficial lawmaking and ineffective enforcement.

Regulation by Commission has, no doubt, come to stay; but it has already been over-developed. And here it is alarming to find that the demand is being made by the Interstate and other Commissions for enlarged powers.

Although this feature of our government has come to be more and more in conflict with our boasted traditions, and particularly during the last two years, it is the exception when a voice is raised against this revolutionary departure from a fundamental feature of our form of government. Not a small part of the responsibility for this unfortunate condition must be borne by the owners and managers of the properties—including bankers, business men, small investors, and the officers of the companies, particularly the latter, for they are, or should be, the best informed as to the facts and the questions involved. All directly concerned should be prompt, fearless, diligent to correct misstatements and misinformation and to disseminate the truth, and all done openly and above board. They should also be courageous and untiring in their resistance to persecution and confiscation when it parades under the cloak of regulation.

The constitution of the United States is supposed to guarantee its citizens against the taking not only of life but of property without due process of law. In too many cases this guarantee had been repudiated.

Let us not be put out of countenance because those who, either through ignorance, misdirected zeal, or evil intent point to the misdeeds of some as a reason for punishing all. "Let him who is without sin cast the first stone." Then no stones would be cast. But this is not our defence. We claim that, as a general proposition, our business is carried on with a due regard for the rights of all others concerned. In this respect we invite comparison with those of other vocations, and particularly we invite comparison with professional reformers and ear-to-the-ground politicians.

THE SPIRIT OF CO-OPERATION.

Let us be keen to do full justice to all those with whom we deal; let us be prompt to co-operate with the authorities in all their efforts looking to improvement; and having met our full responsibility to those we serve, let us be courageous, diligent, indefatigable in protecting our properties against unfair control and ourselves against unfair and slanderous aspersions.

Our programme is full and rich, and we can now best do our duty to our principals and to those we serve by giving undivided attention to, and a complete discussion of, the papers that are to be presented.

It devolves upon us who reside away from the Pacific Slope to do our utmost to make this congress an unqualified success, if for no other reason than as a recognition on our part of the work of preparation done so generously and efficiently, and in the face of great obstacles, by the officers and members of the Pacific Gas Association and those associated with them.

PRESIDENT'S ADDRESS—Mr. E. C. JONES, of San Francisco.

The year 1915 is a period of unusual happenings; and the American Gas Institute, in holding its tenth annual meeting in San Francisco, on the shores of the Pacific Ocean, is justifying its claim of including the whole United States in its field of activities. This is the first time in the life of our industry that an American Gas Association has held a meeting west of Denver; and if we think for a moment, the reason becomes clear.

Ours is a busy fraternity, dealing with the manufacture and distribution of a product still mysterious and little understood by the public; and it is only the unceasing vigilance of the gas engineer which ensures uninterrupted service. The active, alert men of the gas business cannot travel far from the scene of their duty; and a trip to California is an event of a lifetime. To fully appreate the distance travelled by most of our members to attend is meeting, it is necessary to study a map of the world.

San Francisco is nearly 3300 miles from New York. If the oints of a pair of compasses are placed on New York and San rancisco, and the distance is used as the radius of a circle with ondon as its centre, the circle includes the whole of Newfound-nd, part of Labrador, the whole of Greenland, all of Europe, cluding a portion of Siberia; it reaches beyond Suez, and nbraces about one-fifth of Africa. In other words, if a Gas ongress were held in London, it could be reached by everybody Europe, Northern Africa, Greenland, and Newfoundland, with-t travelling any farther than from New York to San Francisco. hese facts are rather appalling; but they are more than equalled y the enthusiasm and fraternal spirit which bring this gathering f gas men together.

Our California is an empire in itself; and with its more than 00,000,000 acres of land, it would hold the entire population of e world with less than sixteen persons to an acre. I can see in e future an increasing industrial, agricultural, and commercial nportance which will bring California so near to the east that as Institute meetings in San Francisco will be necessary and equent. The gas men of the Pacific Coast appreciate the honour f having this meeting in San Francisco, and it will redound to e credit of the Institute for proclaiming that its title of "Ameri-an" covers the United States from ocean to ocean.

An innovation in the Institute work was the appointment of a ommittee on Collective Gas Exhibit for the Panama-Pacific Inter-ational Exposition; and had it not been for the effective efforts f your Committee, our industry would not have been represented this great world's exposition.

The Collective Gas Exhibit occupies 10,000 square feet of floor pace in the Palace of Manufactures, and is illustrative of the anufacture, the distribution, and the uses of gas. The exhibit lighted by gas, and is a convincing exponent of the economy nd efficiency of gas illumination. The Grand Prize, which is the ighest award in the gift of the Exposition, was awarded to the ollective Gas Exhibit; and on the special exhibitors' day of the anufacturers and Varied Industries Palaces, the first prize, a ilver loving cup, was awarded to the Collective Gas Exhibit for e most attractive and best decorated exhibit in the Palace of anufactures. This unqualified success of an Institute Com-ittee dispels any unspoken thought that the Institute is not eenly alive to the growing importance and boundless possibilities f the gas business.

Your President urges a close study by the captains of our in-ustry of the report of your Public Relations Committee. This eport discloses the fact that the work of this Committee in the ducation of the public mind along economic lines has advanced he cause of gas in the betterment of service to the public, and he saving of waste to the manufacturer by intelligent regulation f the quality of our product.

The work of this Committee, together with the constructive and tandardizing work of your Technical Committee, and the various o-operating Sub-Committees, places the American Gas Institute n the front rank of national engineering societies, and enhances he value of membership. A continuation of this work should be ostered and appreciated by the gas undertakings of this country o such an extent that our membership should be largely in-reased, and the Institute become a clearing-house for the settle-ent of questions of policy relating to all departments of the gas usiness. This leads to the thought of the wisdom of continuing he life of active and important Committees engaged in progres-ive investigations.

On account of our participation in the International Gas Congress, the proceedings of our tenth annual meeting will consist ainly of the reports of Committees; and your Board of Directors as chosen this opportunity to prepare an index of the proceedings of the past decade covering the life of the Institute, which will add materially to the value of our published "Proceedings."

Your President has spent forty years of unfaltering devotion to he gas business, and thirty-six years to Association work; and uring that time—filled with its failures and successes, menacing competitions, and triumphant advancement—no fear of the future glory of the gas business, nor loss of faith in its eventual predominance, has ever crept in.

The future of the gas business looks very bright. We are the purveyors of a commodity which has become a public necessity, and before us lies a field of opportunities. We are dealing with British thermal units; and with a knowledge of their application, gas should be pre-eminent where heat, power, or illumination is needed in domestic and industrial economy.

The success of our business depends upon the individuals engaged in its various departments; and a grave responsibility rests upon the men who are the framers of its destiny. An unshaken belief in the efficiency and economy of gas for all purposes is necessary to a permanent development of the business; and the agents must be gas men, not gas and electric men. Gas and electricity cannot be well and impartially served by the same hand.

While new extensions are necessary to expand our business as communities grow, the greatest and most fruitful field will be the development of new uses for gas among present consumers. As men must be the potent factors in the upbuilding of our industry, it rests with the Gas Associations of our country to educate the men; and therein lies a wide scope of usefulness for the American Gas Institute.

Death has taken eight of our members during the year; and it has been the custom to record the death of a member by inscribing his name and the date of his death on a memorial page in the "Proceedings." While I do not approve of the ordinary eulogistic obituary notices, it seems to me that the dignity of membership in the American Gas Institute calls for more than passing notice, when it is terminated by the hand of death. I therefore recommend for your consideration the appointment of a Committee on Necrology, whose duty it shall be to prepare biographical notices of all deceased members for publication in the "Proceedings." These notices will have historical value; and if a man's life work has been of sufficient importance to recommend him to membership in the Institute, then a record of his work should be a valuable addition to the history of our industry.

CONTACT OF LAW AND ENGINEERING.

So far as was indicated by remarks made in the subsequent discussion, there appeared to be general agreement among those present—the attendance would not have been looked upon as a large one in ordinary times, but under the existing conditions (absences elsewhere, press of work, and the difficulty of getting about the streets at night) it may be said to have been fairly satisfactory—with the main suggestion put forward in a paper read on Monday of last week before the Society of Engineers, on "Law and Engineering—Some Points of Contact."

The reader of the paper was Mr. Sydney G. Turner, Barrister-at-Law; and the suggestion referred to as having been favourably received was that the close connection which exists between law and engineering would amply justify the establishment of some periodical meetings, similar to those of the Medico-Legal Society, at which lawyers and engineers could discuss the many subjects which are of mutual interest. Some idea of how wide the range of this subject is was afforded by the paper, although it was admittedly impossible to deal with them all. In the unavoidable absence of the President (Mr. Norman Scorgie), the chair was taken by Mr. Percy Griffith, who, before inviting criticism of the paper, announced that this particular point had been already considered by the Council of the Society; and it had been unanimously decided that, should any opportunity arise for arranging such meetings, the Council would welcome the idea. That was to say, they agreed with the utility of the suggestion.

Mr. Turner quoted, in his opening remarks, from an introduction written in 1911 by Lord Justice Fletcher Moulton (as he then was) to Mr. L. W. J. Costello's book entitled the "Law Relating to Engineering." One part of this was: "The profession of an engineer involves much more than mere engineering knowledge or even executive skill. In a large proportion of the matters in which he is consulted, he has the responsibility of giving advice; and this advice often relates to acts in which the rights of third parties are directly or indirectly involved. This consideration alone would make it desirable that he should have a sound knowledge of such branches of the law as bear upon the questions he has to resolve. But his need of clear legal conceptions does not depend on this alone. He has not only to administer, but often to frame, contracts of a character which, beyond doubt, renders them the most complicated of any that have to be interpreted and pronounced upon by our Courts; and their nature is such that he can only pass on the responsibility to professional lawyers to a small extent. The rest deals with matters so technical that it must remain in his hands." Mr. Turner, knowing from experience the needs of the other side, added to this the assertion that, if it was necessary for the engineer to possess some legal knowledge for the proper exercise of his profession, it was no less necessary for the lawyer who was conducting a technical case to have at least such a "bowing acquaintance" with engineering as to enable him intelligently to cross-examine the expert witnesses on the other side.

In the course of his paper, the author made as wide a survey as was possible in the time at disposal of the field of engineering practice, with a view to giving illustrations of some of the more important points of contact between law and engineering. First taking those common to every branch of engineering, he dealt with expert evidence; remarking that, though as a general rule the mere opinion of an individual is inadmissible as evidence of a material fact, there has long been an exception in favour of the admissibility of the opinions of skilled witnesses, whenever the subject is one upon which competency to form an opinion can only be acquired by a course of special study or experience. Then allusion was made to arbitration, as being another ground upon which the lawyer and the engineer frequently meet; and, in this connection, the author pointed out that the position of the engineer as arbitrator is often one of peculiar delicacy and difficulty. Then the subject of contracts was touched upon; and as to these, it was truly said they constitute a field in which there is great community of interest between the lawyer and the engineer. The responsibility of the engineer in the giving of certificates is an important matter, which duly received attention in the paper.

The author then passed on to a brief consideration of the points where law touches the practice of each of the principal branches of engineering—dealing first, and at some length, with the various ramifications of municipal engineering. Mr. Turner expressed the opinion that there is perhaps no branch of engineering practice which is so closely bound up with the law as that of municipal engineering. The municipal engineer is charged with the administration of a large number of complex Acts of Parliament; and he must be possessed of a sound knowledge of the general principles of the law and practice of local government. There are, for instance, sewers and drainage, private street improvement works, and matters relating to highways. When on the latter point, the author did not omit to mention the question of liability for damage caused by the use on roads of tar, and by the fumes emanating from creosoted wood paving.

In connection with gas, water, and electrical engineering, also, Mr. Turner showed that the lawyer and the engineer have much in common. Parliamentary procedure must be studied in all cases; and there are various special directions, which will occur to everyone conversant with practice in the different branches, in which community of interest exists to a greater or less extent between law and engineering. Suitable topics for discussion were stated to be the powers conferred, and obligations placed, upon gas undertakings by Parliament, the breaking-up of streets, the law relating to subterranean water and pollution, the damaging of cables, &c.

Several lawyers present, on the invitation of the Chairman, spoke on the paper. The first expressed the opinion that facilities for the meeting of lawyers and engineers for the discussion of matters of common concern, would, from the lawyer's point of view, be considered a very great advantage. Another said that he thought there would not be any risk attendant upon the engineer being in part a lawyer, provided he kept in mind that the knowledge of law he most required was that which would show him where he was on dangerous ground, and where he ought to obtain expert advice. A third stated his belief that a technical witness sometimes made the mistake of being too technical. The simpler and shorter he could make his answers, the more effective his evidence would be. On the engineering side, also, there were several speakers, one of whom agreed that the municipal engineer especially must be acquainted with the law connected with his profession; otherwise he would be bound to get his council into trouble.

Referring to subjects that might be jointly discussed, Mr. Percy Griffith remarked that the Water-Works Clauses Act of 1847 was ripe for revision, more especially in the direction of consolidation. Those who were concerned with gas and water legislation were aware of the Model Bill, which was one of the best things he (the speaker) knew of in connection with Acts of Parliament, in that it was subject to periodical revision and bringing up to date. He had great admiration for this arrangement; but the amendment of the Model Bill was effected to meet a particular practical emergency. That was to say, the law came and took into practical consideration the engineering side of the question, and made the law to meet a particular class of case. The Bill had been constantly amended and added to; and at the present moment he believed the Model Bill clauses were a great deal longer than any other clauses in a Private Bill. A suggestion which might reasonably be made at the present time was that the general law might be brought up to date, and displace the Model Bill for another period of years, and so save a great deal of trouble. Another interesting question with regard to water supply was the definition of "domestic supply." Then there was the question of standardizing clauses for contracts. These points had been already considered to some extent by the Institution of Water Engineers; and as Secretary of this body, he had had to study them. Those who were interested in any branch of engineering should make a point of collecting cuttings of legal cases referring to their branch, and reading carefully the arguments upon which the decisions in the cases were based.

A hearty vote of thanks was passed to the author for his paper.

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TRAINING OF GAS ENGINEERS.

The "Gas Engineering" Course at the University of California.

In a recent number of the "Gas Age" (New York), Professor R. S. Tour, of the University of California, gave details of the course in "Gas Engineering" which has been instituted there, on the initiative of the Pacific Coast Gas Association. The following are some extracts from the article.

In his introductory remarks the author pointed out that the word "engineering" no longer has the narrow meaning it once had, and that the engineer, in his ever-increasing field of activity, has been called upon to operate and manage as well as to design and construct. Operating and managing require knowledge and training peculiar to the particular industry concerned. This directly points to specialization, which is inevitable for the engineer of the future; and, in the author's opinion, the gas industry offers opportunities for technically trained men which warrant the serious consideration of gas engineering as a profession by those who contemplate technical work as a career. The gas industry of the Pacific Coast has specially brought this out. Up to the last few decades illuminating gas was produced mainly from coal, in accordance with the generally accepted methods in use in other portions of the United States. But the scarcity and high cost of solid fuel made it an economic necessity that liquid fuel should be the raw material for the manufacture of gas. Gas engineers of the Pacific Coast had consequently to leave the well-trodden paths followed by their colleagues, and develop new methods and apparatus for making gas. So abundant has been the production of oil (from less than a million barrels in 1894 to nearly 100 millions in 1913), and so rapid the development of oil-gas manufacture, that the field has been very promising for properly trained men, in both the research and operating departments; and naturally the most desirable men would be those trained on the Pacific Coast, in the midst of the economic and industrial conditions existing there.

Holding this opinion, a Special Committee previously appointed by the Pacific Coast Gas Association reported in the year 1911 that it would be desirable for the University of California to establish a special course in "Gas Engineering." The Committee had a meeting with Professor C. L. Cory, the Dean of the College of Mechanics, and tentative plans for such a course were agreed upon. At the annual meeting of the Association in the autumn of the year, the report of the Committee was accepted, and voluntary contributions were asked for to maintain a fund for the course in the University.

At the annual meeting of the Association in 1912, the scope of the proposed course was discussed, and a paper on "Gas Engineering in American Universities," was read by Professor Robert Sibley, then of the Mechanical Engineering Department of the University; and the desirability of conferring a specific degree of "Gas Engineer" on the completion of the course was seriously considered. The specialized studies along gas engineering lines at other universities were investigated, especially the "Fellowship of Gas Engineering" maintained at the University of Michigan by the Michigan Gas Association—this being the most typical of the specialized courses given along this line at any university. However, it was thought that a similar Fellowship in the University of California should not be offered, but that a course, available to a number of men, of a more general nature and of longer duration than a fellowship, would be more useful.

Subscriptions to the Association fund for "Gas Engineering" guaranteed a sum of $2700 per annum for a period of five years, to assist financially the development of a "Gas Engineering" course in the University of California. After a conference of the Special Committee of the Association with the Engineering Faculty of the University, it was decided to establish a chair of "Gas Engineering" and to equip a gas laboratory. It was also agreed that practising gas engineers on the Pacific Coast should deliver a series of lectures at the University in connection with the regular studies that would be offered in the course. It was kept in mind that it was absolutely essential to the success of the course that there should be lasting and continuous co-operation between the University and students on the one hand and the Association with its individuals on the other. The academic year 1912-13 marked the inauguration of a tentative course—the special feature being the lectures given by members of the Association. In the autumn of 1913, the author, who was at the time with the Consolidated Gas Company of New York City, and previously holder of the Gas Engineering Fellowship of the University of Michigan, was invited to the University of California; and during the ensuing year a lecture course on gas manufacture, known as "Gas Engineering 117," was instituted.

During the year 1913-14, the gas engineering laboratory was installed in the Mechanical Engineering building of the University. It is a combined chemical and engineering laboratory, and provides facilities for making any of the varied tests or experiments which might become necessary in a gas manufacturing or gas power plant. Beginning with the above-named year the following four-year complete course of study was outlined for those students who desired to specialize in "Gas Engineering;" this course being open to any students entered in the College of Mechanics. During the spring of 1915 the course was agreed to by the faculties of the Colleges of Engineering, and is now a distinct, well-defined, and separate engineering schedule leading to the degree of B.Sc. (in "Gas Engineering").

SCHEDULE OF STUDIES.

Note.—One unit represents one lecture or recitation per week for one semester of about sixteen weeks. Laboratory work is rated at three or four hours per week for each unit. The schedule for the first year is common to all courses in engineering.

FIRST YEAR.

	Units. 1st Sem.	Units. 2nd Sem.
Mathematics 3A–3B.—Algebra, analytical geometry, and the first elements of the calculus—lectures and recitations	3	3
Physics 1A–1B.—Mechanics, properties of matter, and heat lectures, recitations, and laboratory	3	3
Chemistry 1A–1B.—General inorganic chemistry and qualitative analysis—lectures, recitations, and laboratory	5	5
Civil Engineering 1A–1B.—Theory and principles of surveying—lectures and recitations	2	2
Do. 1C–1D.—Practice of surveying and mapping—field work	1	1
Hygiene 1*.—Personal hygiene and first aid—recitations and lectures	2	—
Physical Education 1A*–1B*.—Gymnasium work	1	1
Military 1A*–1B*.—Military exercises on field	½	1
Do. 2A*.—Theory of military tactics	1	—
Elective	—	1
Total . . . . 35½ units =	18½	+ 17

* Required of all first year male students.

SECOND YEAR.

Mathematics 4A–4B.—Differential and integral calculus—lectures and recitations	3	3
Physics 2C–2D.—Magnetism and electricity, sound, light, &c.—lectures, recitations, and laboratory	3	3
Chemistry 6A–6B.—Quantitative analysis—lectures and laboratory	3	3
Drawing 2A–2B.—Descriptive geometry — drawing periods	3	3
Mechanical Engineering 106A.—Machine detail drawing—lectures and drawing periods	—	3
Do. 1A–1B.—Lectures and recitations :—		
Elements of steam engineering	3	—
Elements of electrical engineering	—	3
Do. 8A.—Shop work in wood, pattern making, &c.—laboratory	2	—
Military 1A†–1B†.—Military exercises in the field	½	1
Do. 2B.—Theory of military tactics	1	—
Total 37½ units =	18½	+ 19

† Required of all second year male students.

THIRD YEAR.

Chemistry 8A–8B.—Organic chemistry—lectures and recitations	2	2
Do. 9.—Organic chemistry—laboratory	—	2
Do. 111A–111B.—Physical chemistry, theory and applied—lectures and recitations	3	3
Mechanics 102A–102B.—Engineering mechanics—lectures and recitations	3	3
Mechanical Engineering 106B.—Machine design, theory and practice—lectures and drawing period.	2	—
Drawing 105.—Graphostatics, graphical analysis of stresses in engineering structures—lectures and drawing period	—	2
Gas Engineering 118AB.—Gas engineering—laboratory	1	1
Mechanical Engineering 9A.—Shop work in iron, machine shop, &c.—laboratory	2	—
Electrical Engineering 110A–110B.—Electrical machinery and construction—lectures and recitations	2	2
Do. 110C.—Electrical machinery—laboratory	—	1
Civil Engineering 108A–108B.—Strength and resistance of materials—lectures and recitations	3	2
Total 36 units =	18	+ 18

FOURTH YEAR.

Mechanical Engineering 104A–104B.—Kinematics, theory of motion of machine parts—lectures and recitations.	2	2
Do. 104C–104D.—Kinematics, applications of—drawing periods	1	1
Do. 103A–103B.—Hydraulics and hydraulic machinery—lectures and recitations	3	3
Do. 105A–105B.—Engineering thermodynamics and heat-engines—lectures and recitations	3	3
Gas Engineering 108B.—Internal combustion engines—lectures and recitations	—	2
Do. 117.—Gas engineering; manufacture of gas, construction and operation of plants, &c.—lectures and recitations	—	2
Mechanical Engineering 107A–107B.—Hydraulic experimental laboratory	1	1
Do. 107C–107D.—Mechanical experimental laboratory	1	1
Gas Engineering 120A.—Gas Engineering—laboratory (continued) not less than	1	—
Do. 114.—Thesis—original contribution to gas engineering	2	2
Electives	3	1
Total 35 units =	17	+ 18

Grand total units = 147.

SUMMARY OF COURSE.

	Units.				
	1st Year.	2nd Year.	3rd Year	4th Year.	Total.
Mathematics	6	6	—	—	12
Physics	6	6	—	—	12
Chemistry	10	6	12	—	28
Drawing	—	6	2	—	8
Mechanical engineering	—	11	10	14	35
Do. (hydraulic)	—	—	—	8	8
Gas engineering	—	—	2	9	11
Civil engineering (including summer school)	9	—	5	—	14
Electrical engineering	—	—	5	—	5
Incidental	6½	2½	—	—	9
Elective	1	—	—	4	5
Totals	38½	37½	36	35	147

The author thought it might be well to indicate more fully the scope and ground covered by the courses specifically known as "Gas Engineering," which must necessarily be limited in number. He did so as follows.

Gas Engineering 108B.—A lecture and recitation course of two hours per week on internal combustion engines. This course covers a theoretical consideration of the various cycles with their practical applications of to-day. Prerequisites: Mechanical Engineering 1A and 105A.

Gas Engineering 118AB.—A laboratory course of one afternoon per week throughout the year in the laboratories. The course covers complete analyses of gases; calorimetric determinations of solid, liquid, and gaseous fuels; photometric practice, &c. Prerequisites: Chemistry 6AB.

Gas Engineering 117B.—A lecture and recitation course of two hours per week, with a third lecture on alternate weeks given by outside gas engineers. This course covers the theory, methods, and processes used in the manufacture and purification of gas, including coal gas, water gas, and oil gas. The construction and operation of gas plants is considered in this connection. This course is supplemented by visits to neighbouring plants.

Gas Engineering 120A.—A continuation of 118AB, taking up some of the more difficult determinations, such as naphthalene, ethane in gas, free carbon in tar, condensation of tar particles, tar separation, &c. For this course the student may avail himself of the testing and experimental facilities of any of the neighbouring gas plants; and the extent of the work depends upon the desire and ability of the student.

Professor Tour offered the following observation on the course: It is evident that the "Gas Engineering" course, as outlined, is fundamentally a mechanical engineering course with a strong foundation in chemistry. This combination is what might be known as "Chemical Engineering." This is as it should be; the gas engineering profession involving mainly the application of chemistry and mechanical engineering. A few courses in gas engineering, as such, serve to illustrate this application. A mechanical-chemical engineer is the raw material from which a gas engineer is shaped. It has been the purpose and intent throughout to have the term "Gas Engineer" cover not only the manufacture of gas from fuels, but also the closely allied study of the direct generation of power from these fuels—that is, gas-power engineering or internal-combustion engineering. The rapid rise of the internal-combustion engine, especially where oil is easily available, makes the future of this branch of gas engineering exceedingly bright. This broad view of the term "Gas Engineering" makes the field less limited, and widens the scope of application of the energies of graduates. The course in "Gas Engineering" as outlined in the schedule goes into effect officially in the autumn of 1915. However, a similar outline has been used for students interested; and many have taken the various individual subjects coming under the title of "Gas Engineering." Some of these students have been sufficiently interested on graduation from their respective courses to obtain employment in the gas industry of the Pacific Coast. With the complete outline accepted as a distinct university course, there are many hopeful expectations for the future.

In conclusion, the author quoted some pertinent remarks on the value of a "Gas Engineering" course made by Mr. E. C. Jones, to the Pacific Coast Gas Association in 1911.

COKE FUEL FOR STEAM-WAGGONS.

Last Wednesday, a demonstration run from Wandsworth to Epsom, with a standard 5-ton "Foden" waggon and trailer, hauling a useful load of approximately 10 tons, was organized by the London Coke Committee, with the co-operation of the Wandsworth, Wimbledon, and Epsom District Gas Company. The chief object of the trial—which was attended by a very representative gathering of gentlemen interested in steam haulage, including the Secretary and Engineer of the Commercial Motor Users' Association—was to demonstrate the practicability of using gas coke exclusively as fuel on this type of waggon, without impairing either its capacity or efficiency.

The various inclines on the route were negotiated without stopping to change speed-gears; and a full head of steam was maintained at "blowing-off" pressure throughout the run of some 11 miles, which was completed in good average time. The quantity of coke used was ascertained to be 168 lbs.—a result which was admitted to compare favourably with average Welsh coal consumption. Considerable interest was shown in the trial, inasmuch as the possibility of using gas coke without any alteration to the fire-box, further than re-spacing the fire-bars, was proved, and that an alternative fuel was available while Welsh coal of good quality is practically unobtainable even at much enhanced prices.

The waggon used for the trial was one of a fleet which have been fired on gas coke over a long period, without any detrimental effect on fire-box, tube-plates, or tubes.

British Commercial Gas Association.—The fourth annual general meeting of the Association is to be held in the hall of the Royal Society of Arts, John Street, Adelphi, W.C., at 2.30 p.m. on Tuesday next, the 19th inst. The business to be transacted consists of the presentation of the report of the General Committee and the accounts for the period ending Aug. 31, an address by the President, Bailie Thomas Paxton, J.P., of Glasgow, the election of the President and Auditors for the ensuing year, and the consideration of a motion proposing the continuance in office until the annual meeting next year of members of the Executive and General Committees who would otherwise be now retiring.

Midland Association of Gas Engineers and Managers.—According to the programme for the autumn general meeting of this Association, which (as notified last week) will be held on Thursday at the Grand Hotel, Birmingham, the principal business will be an informal discussion on "Toluol Recovery," to be opened by Mr. Hubert Pooley, of Leicester, and a discussion to be introduced by Mr. W. H. Johns, of West Bromwich, on "War and Gas-Works Labour." It is not intended, however, to report either of these discussions in the Press. The only "open" business to be transacted—after the usual formal business, including the election of officers for next year—will be the reading of a paper by Mr. A. G. Leighton, on "Home Sales of Sulphate of Ammonia."

GAS FROM PEAT.

It was mentioned in the report given recently in the "JOURNAL" of the meeting of the Dutch Gas Association that several trials were intended to be made at the Hague Gas-Works as to the usability of peat as a gas-making material. These trials have been made; and "Het Gas" last month contained an article by Heer Brender à Brandis, the Engineer of the works, as to some results he has obtained.

Two sorts of coarse peat were tried—heavy lumps (A), and small lumps (B). The analyses in the laboratory furnished the following data:

	A.		B.	
Moisture	25·00	per cent.	18·00	per cent.
Volatile matters	48·00	,,	50·00	,,
Sulphur	0·27	,,	0·49	,,
Ash	2·70	,,	5·00	,,

For the distillation of the peat a 10-feet horizontal retort was used—separated from the other eight retorts in the bench, so that it was possible to have the gas separately taken off, purified, and tested. The working temperature was the same as in the whole bench in regular use for the distillation of coal, as a lowering of the temperature was not advisable for the regular working of the other retorts of the bench.

In treating the peat, it proved impossible to have the retort charged with the full load of from 160 to 170 kilogrammes of the material, as the production of gas in the first period of carbonization was so excessive that the later parts of the experimental plant were not adequate in size for dealing with the great rush that resulted. The gas broke the water-seal, and in an instant the room where the experimental plant was situated was filled with peat gas. This necessitated the working exclusively with small lots not exceeding a hundredweight—a circumstance that must be remembered when gauging the results and the composition of the gas, as the volume of air in the retort obviously had some influence on the amount of nitrogen in the gas. The experiments with mixtures of peat and coal were made with normal charges of 160 kilogrammes.

The coke produced was weighed after quenching; and though a minimum of water was used, the coke from the peat was found to be more porous than that of gas coal, and so took more water. Furthermore the sulphur in the purified gas was estimated in the pure peat gas only, as in the mixed peat and coal gas the amount of sulphur depends mainly on the character of the coal used.

The question arose as to whether experiments with mixtures of coal and peat were necessary; and the question was answered in the affirmative, as the carbonization of peat mixed with coal lumps is certainly somewhat different from that in the case when the lumps of peat are exposed directly to the intense heat of the sides of the retort.

During the experiments no attention was paid to the production of tar and ammonia—more especially because the principal question to be determined was whether peat can be used in cases of emergency for the production of town gas.

EXPERIMENT I.—*Carbonization of Peat "A" only.*

The gas production per metric ton was 17,885 cubic feet; production of coke, 33 per cent. (wet); gross calorific power of the gas, 385 B.Th.U; specific gravity of the gas, ·670; sulphur in the purified gas, 9·7 grains per 100 cubic feet.

Composition of the Gas.

Carbon dioxide	15·6	volumes per cent.
CnHm	2·7	,,
Oxygen	0·8	,,
Carbon monoxide	21 0	,,
Methane	13·7	,,
Hydrogen	37·0	,,
Nitrogen	9·2	,,

The coke was very bad, consisting of small lumps resembling charcoal.

EXPERIMENT II.—*Carbonization of Peat "B" Only.*

The gas production per metric ton was 17,255 cubic feet; production of coke, 40·2 per cent. (wet); gross calorific power of the gas, 366 B.Th.U.; specific gravity of the gas, ·650; sulphur in the purified gas, 15 grains per 100 cubic feet.

Composition of the Gas.

CO_2	13·0	volumes per cent.
C_nH_m	2·1	,,
O_2	0·7	,,
CO	23·8	,,
CH_4	12·1	,,
H_2	39·6	,,
N_2	8·7	,,

The coke was of somewhat better quality than that of "A." It is usable in a stove. It is, however, very brittle and unfit for transport.

EXPERIMENT III.—*Carbonization of English Gas Coal Only.*

The gas production per metric ton was 10,097 cubic feet; production of coke, 76 per cent. (wet); gross calorific power of the gas, 558 B.Th.U.; specific gravity of the gas, ·401.

Composition of the Gas.

CO_2	1·9	volumes per cent.
C_nH_m	3·4	,,
O_2	0·8	,,
CO	7·1	,,
CH_4	29·0	,,
H_2	53 3	,,
N_2	4·5	,,

The quality of the coke was good—large lumps, with only a small proportion of breeze.

EXPERIMENT IV.—*Carbonization of 80 per Cent. of Gas Coal with 20 per cent. of Peat* "A."

The production of gas per metric ton was 12,635 cubic feet; production of coke, 69·2 per cent. (wet); gross calorific power of the gas, 472 B.Th.U.; specific gravity of the gas, ·476.

Composition of the Gas.

CO_2	6·0	volumes per cent.
C_nH_m	2·4	,,
O_2	0·9	,,
CO	10·9	,,
CH_4	19·6	,,
H_2	51·4	,,
N_2	8·8	,,

The quality of the coke was fairly good. The peat coke is distinctly visible, as small lumps resembling charcoal.

EXPERIMENT V.—*Carbonization of 80 per Cent. of Gas Coal and 20 per Cent. of Peat* "B."

The production of gas per metric ton was 12,728 cubic feet; production of coke, 69·7 per cent. (wet); gross calorific power of the gas, 495 B.Th.U.; specific gravity of the gas, ·541.

Composition of the Gas.

CO_2	6·6	volumes per cent.
C_nH_m	3 0	,,
O_2	0·9	,,
CO	13·2	,,
CH_4	22·3	,,
H_2	47·2	,,
N_2	6·6	,,

The quality of the coke was fairly good. In this coke also the peat coke was clearly distinguishable; but the lumps were larger and less brittle.

EXPERIMENTS VI. & VII.—*Carbonization of 90 per Cent. Gas Coal and 10 per Cent. Heavy Peat "A" and "B."*

The gas production per metric ton was (A) 11,672, (B) 10,976 cubic feet; coke production (wet) (A) 72, (B) 72·4 per cent.; gross calorific power of the gas (A) 543, (B) 544 B.Th.U.; specific weight of the gas (A) ·448, (B) ·469.

Composition of the Gas.

	A.		B.	
CO_2	4·2	vol. per cent.	4·6	vol. per cent.
C_nH_m	2·9	,,	3·0	,,
O_2	0·9	,,	0·7	,,
CO	10·0	,,	10·5	,,
CH_4	25·1	,,	24·9	,,
H_2	53·0	,,	51·9	,,
N_2	3·9	,,	4·4	,,

In both cases, the quality of the coke was good, and no separate peat coke was to be seen.

The conclusion arrived at from these experiments and the resulting figures is that the carbonization of peat produces a large quantity of gas, but as compared to coal gas of inferior quality. In emergency cases, however, the limited addition of peat to gas coal may be of use, without the quality of the gas being lowered too much. The coke produced is a good workable kind; and the production of gas per ton of the prime material increases considerably. But the use of peat for gas-making purposes has more interest for gas-works with coal-gas benches and horizontal retorts only. For works with water-gas plants or with vertical retorts, the calorific power of the gas produced will be too noticeably lowered by the addition of peat gas to the mixed gas.

War Bonus Question at Oldham.—There appears to be a good prospect of a peaceful termination to the dispute between the Oldham Corporation and the Gas-Workers' and General Labourers' Union. The members of the Union in the employ of the Corporation had decided to come out on strike to enforce their demand for a general war bonus of 3s. per week, in place of the bonus of 2s., to those in receipt of less than 30s. which the Corporation are now paying. At a mass meeting of the members of the Union held last Tuesday, Mr. J. R. Clynes, M.P., the General Secretary of the Union, said that the notices tendered should have expired on Wednesday; and he read a letter he had sent to the Board of Trade, in which was set forth the claims made by the men and the refusal of the Corporation to agree to arbitration or to a further conference. In the letter he finally stated: "We now find it is claimed by the gas management that gas workers are munition workers, and that badges have been applied for for these men. In case your Department should take this view, and thereby regard the men as disabled by law from ceasing work, we conclude you will take the necessary steps to settle such claim by arbitration. If not, the men will cease work when their notices expire." On Wednesday, Mr. Clynes received the following telegram from Sir George Askwith: "I am making inquiries into the dispute, and shall be glad if you can arrange in the meantime to postpone further action." The strike notices have now been post-dated 21 days.

REGISTER OF PATENTS.

A New Fuel and Method of Making Same.

Hickman, T. M., of Wolverhampton.

No. 4214; Feb. 18, 1914.

For this invention—which was recently referred to in the "Journal," Vol. CXXXI., p. 399—the patentee makes the following claim: "A process for converting by dry distillation carbonaceous matter possessing little or no coking properties into coked fuel of any desired hardness, which consists in incorporating with the carbonaceous materials, previous to or during distillation, natural or artificially prepared compounds of aluminium and silica, containing in chemical combination therewith alkalies or alkaline earths, magnesium, or iron (or such other metals which can take the place of iron and have the same effect in the combination), in such quantities as to obtain the property of great permeability and comparatively low fusibility, and of keeping the particles of the coke formed bound together."

The patentee proposes to artificially impart to non-coking carbonaceous materials the qualities which are naturally inherent in coking carbonaceous materials by incorporating with non-coking carbonaceous materials (such as coal dust, slack, and the like), prior to, or during, distillation, such substances as are naturally found in coking carbonaceous materials. These substances must have the property of being fusible, so as to thoroughly permeate the whole mass during distillation, and of binding together the particles of coke formed.

He has found suitable for this purpose natural or artificially prepared compounds of aluminium and silica containing, in chemical combination therewith, any or all of the above-enumerated substances. Among the natural materials, the following substances occasionally contain the particular compounds, and may be used as admixtures—namely, fire-clay or ball-clay, shale or red clay, gault, marl, or zeolites. Among the latter are included a number of minerals formed by the action of the weather from felspars, such as kaolin, from potash felspar, or calcareous zeolites (chabasite, phillipsite, desmine), or those formed from soda felspar, such as analcime and natrolite.

As it may not, however, be in all cases easy, he says, to find a perfectly adapted natural mineral, it is preferable to treat the natural bodies in such a way as to increase their fusibility and binding power. For instance, when an infusible clay has to be used, this can be converted into a fusible compound by treating it in a furnace or autoclave, with alkali or lime, whereby the respective compounds of alkali or lime with alumina and silica are formed. These compounds may then be treated in the furnace with a metallic salt or compound—*e.g.*, of iron—or a salt or compound of such other metal, which can take the place of, and has the same effect in the alumino-silicate compound as iron. The iron or like metal replaces the alkali or lime of the alumino-silicate compound in a well-known manner.

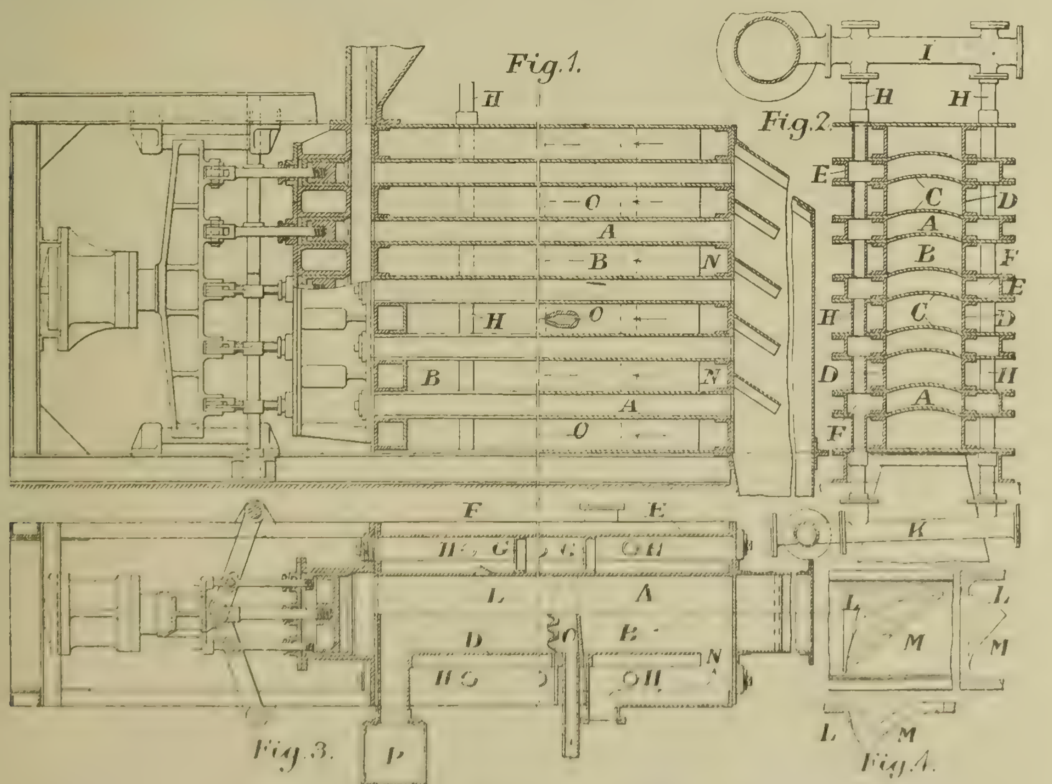
The density and hardness of the coke obtained will depend upon the proportion and the nature of the added material, and the degree of heat to which it is subjected.

The exact choice of the admixture to be used with the best effect depends naturally on the constituents of the mineral ash of the non-coking carbonaceous material, which differ very largely in various coalfields, and which must be ascertained by analysis. Thus if the ash of a non-coking carbonaceous material consists chiefly of a siliceous matter which is practically infusible, an admixture capable of producing a fluxing action will be required, such as is afforded by a compound of aluminium and silica containing iron in chemical combination therewith, and also containing in combination magnesium or alkali or alkaline earth. On the other hand, if the ash of a non-coking carbonaceous material consists chiefly of bases, a higher proportion of iron or other metal which can take the place of, and has the same effect in the combination as, iron, but a less proportion of alkali or magnesium, would be required in the alumino-silicate compound to be employed.

The hardness of the coke depends on the fusibility, permeability, and also on the contracting power of the admixture. Some of these compounds will contract, it is said, by as much as 10 per cent. of their volume on cooling.

In carrying the invention into practical effect, the ash constituents of the non-coking carbonaceous material are first ascertained by analysis; and according to the result of the analysis the selection of the binding substance is made, in the manner described. The carbonaceous material is powdered finely or coarsely as desired. If finely powdered, the material may be charged more compactly than in a coarse state. The binding material is then incorporated, either in a finely-powdered dry state or with the aid of water. According to the desired hardness of the coke, a proportion from 3 to 8 per cent. of the admixture is used. The mixture is then subjected to distillation—the coke being formed from the carbonaceous residue by the cementing action of the fused admixture, which becomes liquid, permeates the whole mass, and combines with the mineral matter contained in the carbonaceous material.

As the ash constituents of the carbonaceous material vary considerably, it would not be of much use, the patentee remarks, to give a typical example with exact figures. For the practical carrying out of the invention with the best results, it is therefore advisable, after having ascertained the nature of the admixture required by analysis, to adjust the exact conditions—*i.e.*, admixtures, temperature, and exact amount of coking, according to the result desired. Under suitable conditions—provided that the ash constituents of the carbonaceous material have been ascertained, and the choice of the admixture made in accordance with the directions given—it is possible to obtain the hardest and densest coke, suitable for metallurgical purposes, of the same quality as is manufactured in coke-ovens.



Duckham's Low-Temperature Carbonization Plant.

Carbonizing Fuels.

Duckham, A. M'D., of Ashtead, Surrey.

No. 13,934; June 9, 1914. Redated Jan. 5, 1915.

This invention relates to retorts "in which the material to be carbonized is caused to travel through a region in which the temperature rises progressively in the direction of travel, or through zones of successively bigher temperature, and the products evolved as gases or vapours are separately collected at successive points in the path of the material or at each zone." In this continuous process of fractional destructive distillation, it is said that "a better yield of the more valuable products is obtained." The process is "particularly applicable to the carbonization of coal and to what is known as low-temperature carbonization for producing a substantially smokeless fuel which burns more readily than an ordinary gas coke."

The patentee proposes to employ, in a bench of retorts, collecting chambers adapted to keep separate the volatile and other products of distillation from the zones of different temperatures—each chamber being connected to the correspondingly situated chambers in the retorts adjacent to it on either side. Finely sub divided coal may be fed at frequent intervals into one end of a horizontal, inclined, or vertical retort so as to pass through it in a direction the opposite to that in which the heating gases are flowing around the retort. At suitable distances apart along the retort are openings in the sides, so formed that the coal in its more or less carbonized condition does not pass through. The retort being heated most highly near the end from which the carbonized coal is discharged, while its temperature decreases progressively towards the end into which the coal is fed, each of the openings corresponds with a zone of different temperature; and the gases and vapours which issue from each opening can thus be collected separately. In the final (hottest) zone, the chief production of ammonia will occur, and here steam may be introduced.

Apparatus, as outlined above, for low-temperature carbonization is illustrated. Fig. 1 is a longitudinal vertical section; fig. 2, a cross section through the retorts and heating flues; fig. 3, a sectional plan; fig. 4, a detail view (enlarged) in plan and two sections in planes at right angles to each other.

The horizontal retorts A and heating flues B alternate with each other in a vertical column which is built up (as described in patent No. 13,935 of 1914) of steel plates C held between channel irons D. The plates are considerably wider than is necessary for forming the retort, and are connected at their edges by channel irons E to form a chamber F at each side of the retort and co-extensive with it. The chamber is sub-divided into a number of collecting chambers by transverse partitions G, each connected with those above and below by a pipe H. Thus there is a common passage for gases upwards from all chambers opening into zones of the same temperature to collecting mains I provided for each of the zones of different temperature, and for liquids downwards to the collecting main K. Other collecting mains and pipes connect with chambers having access to zones of other temperatures. Openings L in the walls of the retort afford passages for volatile products from the retort to the collecting chambers; the solid material being retained by the tongue M formed by cutting the metal along lines which meet at an angle to each other and bending outwards the piece within the angle, as shown in fig. 4.

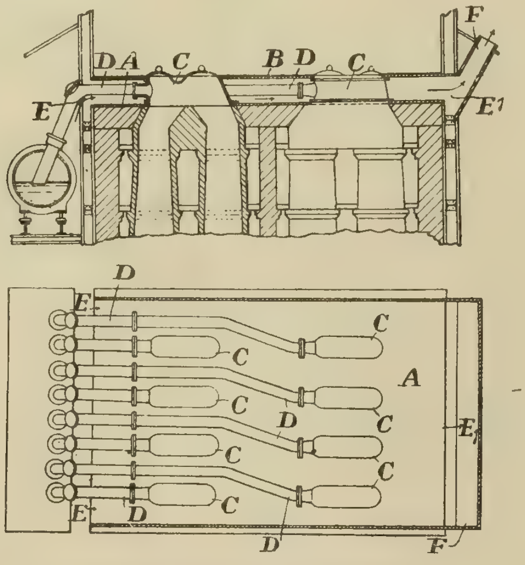
At the end of each channel iron that constitutes the side of a flue B which is nearer the discharge end of the retort, a portion is cut away to form an inlet N for air. The gas for the heating flues is supplied from a main to the burners O near the discharge end of the retorts which deliver gas in the same direction as the draught of air. The products of combustion leave the flues at the charging end of the retorts and escape to the flue P.

Vertical Gas-Retorts.

Julius Pintsch Aktiengesellschaft, of Berlin.

No. 16,199; July 7, 1914. Convention date, Oct. 11, 1913.

In the words of the patentees: "This invention relates to destructive distillation apparatus of the retort-furnace type—that is to say, of the kind wherein retorts are arranged in a vertical position within furnace chambers with their upper portions embedded in a top wall forming part of the furnace chamber surrounding each retort; the covers of the retorts and the branch pipes leading to the tar-pits being above the furnace, and over these a floor or plating being placed along which the attendants pass. The heat radiating from the retort heads or covers, and that produced by the hot gases passing through the pipes leading to the tar-pits, heats the floor plates to such an extent that it is practically impossible for the attendant to remain on the upper floor or passage for any length of time." The object of the present invention, therefore, is to provide means for producing and maintaining a current or circulation of air between the top of the furnace and the floor or passage used by the attendants. If the current cannot be produced by natural means (differences of temperature), auxiliary means—such as a blower or ventilator—may be employed.



Pintsch's Vertical-Retort Arrangement.

A vertical longitudinal section through the suggested apparatus for the purpose is given; also a plan in section.

The flooring or platform B for the attendants lies substantially flush with the retort heads or covers C; and some distance above the top A of the furnace, and between the platform and the furnace top, pipes D are arranged leading from the retort heads to the tar-pits. Between the furnace top and the platform a circulation of air is maintained; the air entering the space between the two surfaces at E and passing off again at E^1. In order to increase or maintain a proper draught or circulation, a shaft or prolongation pipe, blower, or ventilator may be provided at F.

Trinitrotoluene Manufacture.

Società Italiana Prodotti Esplodenti and Ferdinando Quartieri, of Milan.

No. 19,566; Sept. 6, 1914.

The patentees point out that, in the ordinary process of manufacturing trinitrotoluene, toluene is used as raw material, and by suitable nitrations it is made into mononitro-, then into dinitro- and last into trinitro-toluene; or, better, the mononitro- is transformed directly into trinitro, or also the toluene may be transformed with only one nitration to the dinitro- and then the latter to the trinitro-toluene. In all these various processes there is the drawback of an abundant formation of a liquid product which, if it is not conveniently separated, gives rise to an impure trinitrotoluene, which must be crystallized from alcohol or other solvents in order to obtain it at the degree of purity required for the preparation of exploding charges.

According to the present invention, the solid dinitrotoluene, obtained from toluene by any known process, is submitted to a partial and fractional liquefaction, whereby pure dinitrotoluene and a liquid containing impurities are obtained. The pure dinitrotoluene is heated gradually to 110° C., with addition of a nitric sulphuric mixture (having 20 to 30 per cent. of nitric acid) in the proportion up to about four to five times the weight of dinitrotoluene. By slowly cooling the mass thus obtained, abundant crystallization of pure trinitrotoluene takes place, which is washed with water and then melted into a vacuum to eliminate volatile impurities, such as the acids. A pure product is thus obtained which, after being granulated and dried, is said to have an extremely high degree of solidification—namely, about 80·5° C.—and has the same properties as that obtained by crystallization from volatile solvents.

The liquid containing impurities obtained during the purification of the raw dinitrotoluene is separated from the mass and nitrated separately to obtain solid dinitrotoluene, which, in its turn, serves as the starting material for the production of pure trinitrotoluene, as stated before.

Recovering Ammonia in the Form of Sulphate from Gases.

Rigby, T., of Dumfries, and Wetcarbonizing Limited, of Dean Farrar Street, Westminster.

No. 18,559; Aug. 11, 1914.

This invention relates to the obtaining of ammonium sulphate free from discoloration in the gasification or the destructive distillation of combustible materials.

The patentees say they have found that discoloration of the sulphate—apparently due to the presence of small residual quantities of tar in the sulphate liquor—"can be readily overcome by utilizing in an improved manner the affinity which certain oils are known to possess for such impurities." According to their present invention, the oil is brought into contact with the sulphate liquor, from which it absorbs impurities; and it is then separated from the liquor, as, for example, by simple decantation.

In carrying out the invention in connection with the utilization of peat in gas-producers, the tar separated from the gases is subjected to distillation, and of the resulting lighter fractions some of the oil is added to the sulphate liquor as the latter passes to the evaporators. The oil and liquor are then thoroughly beaten together until they form an emulsion in which the two liquids are brought into intimate contact with one another, with the result that as the oil has an affinity for the tarry and like impurities in the sulphate liquor it absorbs these from the latter. Separation of the oil from the liquor is then effected in any known manner, as by simple settling and decantation, which is most easily carried out by permitting the mixture to flow into a container having an overflow which allows the oil (on account of its having a lower specific gravity than the liquor) to pass off and be thereafter wholly or in part returned to the gas-washers, where it serves to act as before upon a fresh quantity of sulphate liquor. Before being returned to the washers, however, it may be added to the material entering the tar-stills, in order to free the oil from the dissolved impurities; and after having been thus freed from the oil and impurities, the sulphate liquor is passed to the evaporators as usual.

Distillation of Wood.

Pritchard, T. W., of Wilmington, U.S.A.

No. 20,867; Oct. 12, 1914.

This invention relates to the destructive distillation of wood and other like substances, and has for its object to equalize the heat throughout the mass of material being treated, so that all the material treated will be brought to, and maintained at, the temperature desired for distilling off the more volatile substances present, or for driving off the products resulting from the destructive distillation, and so that all parts of the mass of material are heated up at a uniform rate, and thus prevent any one part of the mass from advancing in its distillation or decomposition faster than other parts. By attaining these objects, the time required for producing successive fractional distillates and for completing the destructive distillation is said to be reduced, and the yield of the more volatile and more valuable fractional distillates is increased.

For effecting the thorough heating of the charge, the gases and vapours generated during the heating are withdrawn from the lower part of the distillation chamber and reintroduced into the upper part, wherein means are provided for introducing into the chamber previous to the distillation a gas which is a non-supporter of combustion; the charge being kept stationary throughout the process.

It has been found, says the patentee, that where a retort has been filled with wood and heated even by the circulation of a heating medium, by means of which a more equable heat throughout the retort can be maintained than can be done by fire heat applied directly to the retort, the temperature at different points in the charge varies sometimes as much as 100° Fahr.; so that, in order that the products which are driven off at a particular temperature may be driven off rom all the wood or other matter which form the charge, it is neces-ary to maintain the heat for a long time at a very considerable ex-enditure of fuel, as, unless this is done, some part of the charge is ot heated sufficiently to drive off the more volatile substances, with he result that these substances remaining in the part of the charge not rought to the proper heat are driven off with the less volatile, and sually less valuable, substances produced by the higher degree of heat ubsequently applied as the treatment progressed towards the complete estructive distillation.

Destructive Distillation of Bituminous Coal.

Blythe, F. C., of Northwood, Middlesex.

No. 19,750; Sept. 14, 1914.

The patentee proposes to add to bituminous coal a proportion of eavy hydrocarbon oil—such as petroleum, kerosene shale oils, heavy ar oils, or heavy hydrocarbon oils—and then heat and distil the mixture nder pressure, which "can be regulated so as to yield from the coal large proportion of hydrocarbon oils and a small proportion of per-nanent gas."

In carrying out the process the hydrocarbon oil is mixed with the ituminous coal in a crushed, ground, or small state—a convenient roportion being about 5 or 10 parts of the hydrocarbon oil to 100 parts f the coal. The mixture is then heated gradually in a closed vessel r still (say) of iron, so that the pressure inside the still rises to about o lbs. to the square inch. The temperature in the still is gradually aised to about 350° C., and then upwards to about 500° C. (or between hese points). A convenient form of still is said to be a cylinder or a ube with an agitator or with a worm or spiral agitator moving the mix-ure forward to the discharge end; but no illustration of the plant uggested is given.

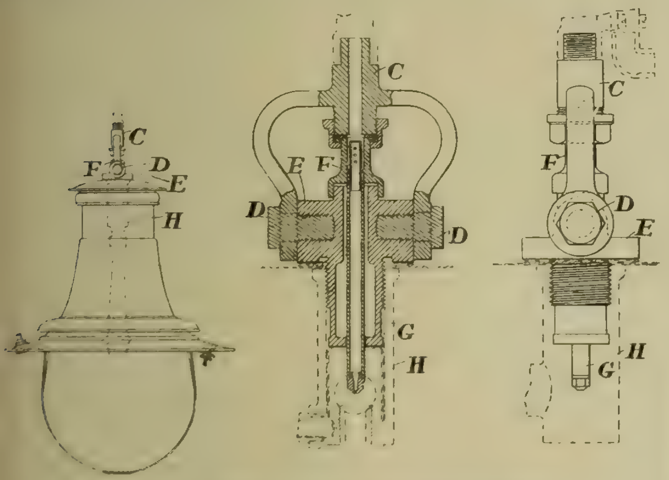
The volatile products which distil off under pressure are cooled and ondensed as far as practicable; and any gas that does not condense nay be used for burning. The presence of the hydrocarbon oil mixed vith the bituminous coal is said to cause a more uniform heating, soft-ening, or melting of the volatile constituents of the coal, and generally cts as a carrier of such constituents. Besides this, the pressure during he distillation prevents to a large extent the formation of permanent as. The hydrocarbon oil so added to the coal will also distil over to large extent and be recovered with the hydrocarbon oils from the oal.

High-Pressure Gas-Lamps.

Cars, B., of Highbury, and Palmer, W. D., of Muswell Hill, N.

No. 24,156; Dec. 16, 1914.

This invention relates to high-pressure inverted gas-lamps of the ype in which the weight of the lamp is supported by trunnion bear-ngs so that it may be swung at an angle to facilitate the removal of he nipple tube (for cleaning or otherwise).



Cars and Palmer's High-Pressure Gas-Lamps.

A side elevation of the lamp is given; also vertical sections of the upper part at right angles to each other.

The tube from which the lamp is suspended may be the tube of the distance lighter or other tubular support. The fitting C, screwed into the lower part of the tube, carries depending arms, the lower ends of which are spread out and are formed with plain holes through which are passed headed studs D, so that the lamp can swing, as on trunnions.

At the upper part of the enlargement E is a cylindrical flange having a plain periphery on which fits (as a cap), in a gas-tight manner, but with capability of sliding, a correspondingly formed enlarged lower end having a cylindrical interior, of a tubular connecting piece F, the upper end of which has a flange engaging by a union nut screwing up so as to make a gas-tight joint. A tube G is provided to carry the burner nipple, and near its upper end the nipple tube is fixed to the tubular connecting piece F by screwing into the lower end of it; the nipple tube passing loosely through the tubular fitting and at its lower end entering the air-box. The upper end of the tube G is provided with a perforated cap of smaller diameter than the base of the connecting piece F. By simply unscrewing the union nut and letting it fall on to the enlarged lower end of the connecting piece, the lamp may be swung out to the requisite angle, so that the operator has only to handle one small part of the lamp while clearing or changing the nipple.

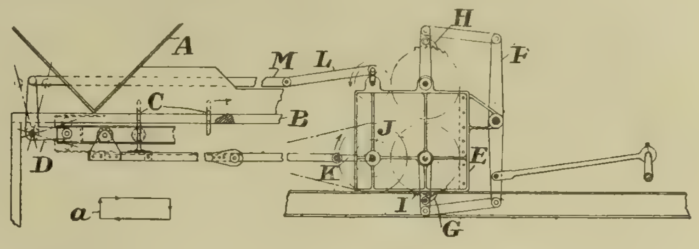
The patentees remark that, by the means described, the weight of the lamp is never borne by the operator; "he is merely required to momentarily use both hands to take out the nipple tube, which he can then manipulate to suit his own convenience."

Screening Coke.

Ordish, F. W., and Robert Dempster and Sons, Limited, of Elland.

No. 1700; Feb. 3, 1915.

The object of this invention is to provide a fixed bar screen (horizontal or approximately horizontal) with conveying or propelling means which will act with a slow movement and without occupying excessive vertical space. For this purpose, fins or rakes are employed which work between the bars, preferably entering the screen from the underside—having either a vertical or horizontal stroke and return, or in some forms a combined vertical and horizontal movement with return clear of the screen, produced by a cam or eccentric.



Ordish and Dempster's Coke-Screening Plant.

The details of the mechanism whereby this invention can be put into practice are capable of numerous modifications; but the patentees show diagrams illustrating two forms of such mechanism.

In the one reproduced, A is a feeding hopper for delivering coke on to a fixed bar screen B, along the surface of which the coke is propelled by rakes C working between the bars. The rakes are carried on a reciprocating frame which runs on rollers upon a rising and falling track, which is raised and lowered by bell-crank level D. The rake frame is shown at the limit of its stroke towards the left-hand side of the parts represented, while the lever and track are shown in full line in their mid-positions. On a fixed framework E is pivoted a rocking lever F actuated by a crank, and driving alternately two pawls G H. The former drives a ratchet wheel I, on the shaft of which is a gear-wheel driving a pinion J, on the shaft of which is a crank K connected by a rod to the frame. The pawl H similarly actuates, through the crank and rods L M, the upper arm of the lever. The rakes thus receive a movement of rectangular character as represented in the diagram shown—the mechanism being then in the phase corresponding to the point A in the diagram; and their return stroke is accomplished while their tips are at a level below the surface of the screen.

APPLICATIONS FOR LETTERS PATENT.

13,709-10.—Woodvine, G., "Laying pipes underground." Sept. 27.
13,716.—Woodvine, G., "Pipe-coupling." Sept. 27.
13,756.—Lennox, A. B., "Distilling tar." Sept. 28.
13,795.—Gould, F. J., "Globe-holders." A communication from G. Ross. Sept. 28.
13,836.—Keith, J. & G., "Gas-burners." Sept. 29.
13,850.—Graham, J. T., "Production of gas." Sept. 29.
13,926.—Hutchinson, B. G., "Prepayment meters." Oct. 1.
13,988.—Bentley, J. E., "Gas-regulators." Oct. 2.

The New London Lighting Order.—It is officially stated that, as the result of the new lighting order, the private and shop lighting of the London area has been brought generally within the required limits. This, however, has had the effect of materially reducing the total illumination of the streets; and since the object to be attained by the reduction of lighting is not a near approach to complete darkness, but a uniform degree of subdued illumination throughout the area, it is believed that, in the process of equalization which is now proceeding, the public lighting of both the main and the side streets may be somewhat increased. Any changes in this direction must, however, be made only on the instructions given by the Commissioners of the Metropolitan and City Police on the advice of the Anti-Aircraft Department of the Admiralty. The Commissioner of Police has urged the local authorities to assist the traffic by whitening street refuges and kerbs at street corners; and this course has already been followed by several borough councils with excellent results.

Advantages of Co-Partnership.—In the course of an address at the Cripplegate Institute, in which he drew attention to the advantages of co-partnership, Mr. Horace Long, the Secretary of the Redhill Gas Company, said: "One of the most significant phases of the development of organized industry in the last quarter-of-a-century has been the conception and adoption of the principles of co-operation. Its object is that the worker shall be inspired and encouraged by the employer (his co-partner) to produce by means of his labour the greatest degree of satisfaction both for himself and his master in the furtherance of a common cause—*i.e.*, the success of the undertaking in which they are mutually engaged. The adoption of the principle may almost be said to obviate the necessity for the supervision of the worker, since the co-partner, possessing a tangible interest in the concern, can be safely relied upon to carry out his duties with attention and care, and to apply himself to his tasks as though performing them directly under the eyes of his employer. Out of the true spirit and practice of co-operation, is thus produced a sense of proprietorship which, in its turn, fosters in the mind of the worker a healthy self-respect and self-reliance (individuality), in comparison with which the mind of the more servile wage-earner is poor, weak, and barren, and without any hope and outlook."

MISCELLANEOUS NEWS.

EVIDENCE ON FACTORY LIGHTING.

The first report of the Home Office Departmental Committee on Lighting in Factories and Workshops, together with its appendices, has been dealt with at length in several of the last issued numbers of the "Journal," and these references may now be supplemented by some notice of the evidence given by the 36 witnesses at the eleven sittings of the Committee (between March, 1913, and February, 1915), which was presided over by Dr. R. T. Glazebrook, F.R.S. The volume containing the minutes of evidence is well arranged, and extends to close upon 200 pages; the questions numbering nearly 4000. In addition to the verbatim report, there is a convenient *précis* of evidence; and the labours of those desiring to follow a single point right through the inquiry are much simplified by a section which very briefly notes the bearing of the statements made by every witness under each separate head.

Mr. *Gerald Bellhouse*, Superintending Inspector of Factories, whose division covers practically the whole of the cotton area, was the first witness. He said that he would like to see the Committee specify that there should be a definite amount of illumination in the neighbourhood of a certain class of work. Without a standard of adequacy, constant disputes must arise; and there was likely to be difficulty in producing evidence sufficient to establish an offence in a court of justice. An effort had been made to lay down a standard at a conference with iron-founders. A proposal was made for a certain ratio of window area to floor-space, and so many foot-candles for artificial lighting where the work was being carried on. A scheme of this kind should be workable, though there were, of course, great difficulties, because there were so many varieties of industry, and what might be sufficient in one case might not in another. Some agreement might have been come to, had not the present Committee been appointed. On the announcement of the Committee's appointment, however, the employers declined to further consider the matter, pending the issue of the report. It might be possible to classify certain processes according to the standard required; but he was not prepared to suggest what the standard should be. This could not be done until the Committee's investigation was complete. He had inquired into the question of bad lighting in relation to accidents in connection with foundries; and it was very difficult to prove that accidents were more numerous in a badly-lighted foundry. He did not feel he could say definitely that the accident rate was high in factories that were bad merely from the point of view of lighting. In a well-lighted cotton mill, for instance, employers got more and better work done. The standard of artificial lighting was improving rapidly in the mills. Incandescent gas was largely used in weaving sheds. Gas was useful in the direction of affecting the atmosphere. It made spinning and weaving better. It was not uncommon in Lancashire to have one light to every two looms; but in many cases there were not. There did not seem to be any definite rule. With regard to artificial lighting of foundries, the proposal that had been made was that 0·3 foot-candle at the point where the work was going on might be regarded as a fair standard. He certainly attached importance to whiteness in walls and ceilings. Most factories, of course, were compelled to limewash every year; but foundries were entitled to exemption.

Mr. *J. G. Clark*, of the Gas Light and Coke Company [who gave evidence along with Mr. *How*], stated that, so far as he knew, the lighting of factories and workshops had hitherto been arranged along lines suggested by experience; and in some cases experiments had been made and trial installations put up. Having regard to the variety of things that went to make good lighting, this method had much to be said for it. In the practical illumination of worshops, conditions were often met with which imposed limitations in the design of the installations. The term adequate lighting, of course, had a wide meaning; but in the case of a new works coming into their hands, they would see that the lighting was satisfactory. He knew of one fitting shop provided with cutting tools, where the illumination in some places was as high as 35 foot-candles; and though this would, of course, be regarded as high, the men were working in great comfort. The lights were well shaded; and there was no uncomfortable glare effect. On the other hand, he had noticed illumination as low as 5 foot-candles with the same kind of work, on cutting tools; and apparently the people had been quite satisfied with it. Of course, the 35 foot-candles was confined to quite a limited space, just where the man was. Mr. F. W. Goodenough in a paper read before the Illuminating Engineering Society in March, 1912,* dealt with printing works lighted by gas; and a case was quoted in which there was an illumination varying from (say) 10 to 12 foot-candles, covering an area of about one-third of the total area illuminated. This was speaking of a composing frame. The other two-thirds were illuminated with from 10 to about 3½ foot-candles. Witness had had no experience of indirect lighting in the case of factories; but, taking illumination as a basis, he should estimate the cost would be something like two to one in round numbers. That was to say, indirect lighting would require twice the expenditure of energy needed for direct lighting, assuming equally efficient sources were used in each case. He should doubt whether increased comfort to the eye, using the indirect system, would to a certain extent increase its sensitiveness, and thus counterbalance the loss of light. Asked what was his idea of minimum general illumination, Mr. Clark said he should feel inclined to put it at something like 2 to 3 foot-candles—preferably 3 for general illumination in workshops. This should be supplemented by local illumination where necessary for the work. Passages, of course, differed; but for an ordinary gangway he would say 1½ foot-candles would be sufficient. Staircases should have a little more—say, from 2 to 3 foot-candles. For lighting in factories, &c., there should be a maximum fixed, as well as a minimum; but the range should not be narrowed too greatly. Though much could be said about glare from an economic standpoint, and also in regard to comfort, he had no knowledge of any harmful diseases arising from the use of unshaded and imperfectly shaded lights. In fact, he had often been struck with the scarcity of spectacles when the lighting would seem to conduce to bad eyesight. But he would strongly urge that the proper use of shades should form a part of any measure that had for its object the reform of lighting. He did not see that any very serious difficulty would be found in designing lighting installations to give an illumination within specified limits.

Mr. *H. C. Wheat*, Illuminating Engineer to the British Thomson-Houston Company, next gave evidence with regard to electric lighting. He said he would like to suggest that metallic filament lamps as ordinarily employed were defective in so far that they showed a great deal of glare. They were often, therefore, a source of danger, because, apart from the general lowering of the visual acuity due to the visible light, the glare had a blinding effect liable to produce accidents by causing operatives to come into contact with the machinery, and other obstructions. The amount of glare could be specified by defining a minimum horizontal distance from which the lamp itself should be visible as compared to its height above the floor. That was to say, a shade should really hood the lamp. Asked what proportion of factories would use indirect lighting, he replied that, according to his firm's experience, the proportion was a very small fraction of the whole, because it was only under quite special conditions that they had as yet used indirect lighting for factory work. He thought it would be possible for the Committee to lay down some definite rules as to the minimum intensities of illumination for different classes of work. Other things which might be specified were the matter of glare or the visibility of the lamps, and possibly sometimes the style of lighting. They did not find that workmen complained of too much light; but they did complain of glare from reflections from the polished parts of machines, and this was why very small lamps were advocated. Witness submitted to the Committee, and explained at length, typical lighting specifications for the different shops in an engineering works, and stated the intensities of illumination which he recommended for the various classes of work.

Mr. *W. Williams*, Superintending Inspector of Factories for the Northern Division, expressed the opinion that in large industries the attention paid to lighting was certainly increasing. In both old and new works, artificial lighting had enormously improved since the advent of the incandescent gas-mantle and cheap electric lighting. In many classes of work, bad lighting did add considerably to the risk of accidents; but it was very difficult to prove this by statistics. He had heard of a case in which one large foundry actually discarded big units of light because it was found that they caused a man to step over a shadow, thinking it was a pit, and to actually walk into the casting. When working in these places, one almost instinctively stepped over a shadow, if it was very deep. He could not see that it would be easy to introduce any definite standard of lighting. What he would very much like to see would be a general requirement such as there was for heating—for example, that the light should be adequate and free from glare. This would leave every case to be settled on its merits, more or less. The heating regulation did not specify a given temperature; it had to be reasonable. Under this section, very great work had been done in getting proper heating. Speaking from an inspector's point of view, he would far rather see a standard adopted for lighting; but it seemed to him that any standard which might be suggested would perhaps have to be lower than one would like to see generally adopted. If general recommendations as to merely adequate lighting were made, the Department would work out some sort of scale for themselves, for the instruction of inspectors; and perhaps after some years of working it would be practicable to fix standards. He would not like to say it was not even now practicable. Asked whether he had any choice of the kind of artificial light to be used, witness replied that he had not, though before the advent of the incandescent system he had a very strong idea against gas lighting. One found the atmosphere got extremely bad with the ordinary gas-burner. He had seen very efficient lighting by the high-pressure gas and oil-gas systems, and by electric arc lights. Some figures as to the variation of light found in different factories were given in a paper read by Mr. A. M'I. Cleland, of Belfast, at a meeting of the Irish Association of Gas Managers in Dublin in 1912*. In a laundry, for example, the minimum illumination at the working-level was 5 foot-candles, and varied from that to about 7½ foot-candles. At a tinsmith's, the variation was from nearly 9 to 12½ foot-candles; and at a fancy-box maker's from 4 to 11¾ foot-candles. Witness's experience was that the various branches of the jewellery trade required a very good light; but the application of artificial light was varied to suit the different branches. Working jewellers commonly worked with an incandescent gas-lamp about 2 feet from their work; but by means of a lens or globe of water they concentrated the light rays on their work. Engravers worked with a low naked gas-flame shaded by means of tissue paper placed between the flame and their work. The work of a watchmaker could be well lighted by an incandescent electric lamp quite close to the watch, and completely shaded from the worker. He had met a watchmaker who said he had had to stop work for about eighteen months owing to the effect of using an ordinary flat-flame burner just in front of his eyes. The incandescent electric lamp was one of the few lights which could be completely shaded and placed near one's face. Any dangerous tool like a saw or a machine-planer could not have too good a light. Roughly there were 2000 accidents from circular saws reported to the Department every year, so that one could not be too careful in dealing with them. Among other things, high illumination was required for artistic work of any sort, and in the examination of finished products, which was frequently very trying to the eye. In a Londonderry stitching factory, where ordinary incandescent electric lights had been replaced by mercury vapour lamps, the women said the new light was softer on their eyes, that the eye-strain was imperceptible, and that headaches were less prevalent than formerly.

Miss *R. E. Squire*, Deputy Principal Lady Inspector of Factories, dealt with cases of insufficient and unsuitable lighting, and stated that tiring effect of electric light on the eyes was a very frequent source of complaint. There were, however, fewer complaints now than was the case when incandescent electric lamps were first used for workrooms. She also referred to a complaint of gas giving a bad light and hurting the eyes of a machinist in a boot factory, where incandescent mantles were said to be impracticable for the sewing machines. It ought, witness thought, to be possible to fix some standard for lighting. In cases of dispute, evidence might be produced before the magistrates from the workers as to the interference with the work and the suffering to their eyes; and one could apply the ordinary rough test as to whether small or medium print could be read in a given place at a given time. The use should be forbidden of places where there was no possibility of working by anything but artificial light. In the Netherlands no woman or girl was allowed to be employed in artificial light between the hours of 9 a.m. and 3 p.m. Of recent times the number of basement rooms had largely increased; and it would be a serious thing to try and enforce such a law as the Netherlands one. There should therefore be an enactment that no room should be built after a certain date which did not meet stated requirements as to lighting. Any part of premises under the Factory Act to which workers had access in working hours ought to be lighted, whether it was technically a factory or a workshop or not. The Truck Act allowed a deduction to be made or payment to be received from the workpeople, for lighting in a factory; and this charge was found in a great many places, chiefly in the Midlands. A charge for gas was almost universally made upon the workpeople; and this, of course, was a survival of the old plan of each worker bringing his own "dip" or candle to work by. But the system had operated to delay the installation of suitable lighting. The employer's charge had generally been made on lines generous to himself; and therefore old gas-burners had been allowed to continue, wasting a large amount of gas. There has been no alteration in most of these places, even when better methods of lighting had been installed in the surrounding premises, because the employer had had no incentive to reduce his charge by an improved system. This provision of the Truck Act should be abolished. It had frequently been found where electric light was to be had in the town, and had been applied even to an employer's own warehouses and offices, the workrooms continued to have the old system of gas-burners, because the workers were still paying for it. The employer knew that if he made any change, the workers would object to having a fresh arrangement, the matter would be discussed, and an altered contract for charges for lighting and the whole question generally would be raised, so that in the end the charge would be abolished, and the whole cost would then fall on the employer. In fact, this consideration was carried so far that just a short time ago witness came across a case in some works where the employees were still bringing their oil-lamps to light the place, though there was electric light in the town.

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* See "Journal," Vol. CXVII., p. 872.

* See "Journal," Vol. CXIX., p. 183.

The witnesses so far dealt with occupied the attention of the Committee during their first two sittings.

OLDBURY GAS ACCOUNTS.

At the last meeting of the Oldbury Urban District Council, under the presidency of Mr. J. W. D. Pratt, the statement of accounts of the gas undertaking for the year ended March 31, prepared by the Gas Engineer (Mr. C. H. Carder), was submitted to the members, and eventually adopted.

Mr. E. W. Jackson (the Chairman of the Gas Committee), in moving the adoption of the accounts, explained that the coal gas made during the year was 148,588,000 cubic feet, or 12,098 feet per ton. The oil gas made was 23,624,000 cubic feet, or 13·72 per cent., showing a total make of 172,212,000 feet. The gas sent out from the works was 172,041,000 cubic feet, an increase over last year of 6,652,000 feet, or 4·02 per cent. The unaccounted-for gas was 10,014,600 cubic feet, or 5·82 per cent. The amount given in aid of the rates by reduced charges for public lighting was calculated at £772 for the year. During the past twelve months the loan account of the undertaking had been increased by £6200, for the construction of a new holder, making the total loan capital authorized £85,399. The loan indebtedness on March 31 was £53,470. In connection with the revenue account as compared with last year, coal, oil, &c., cost more by £913. The total cost of manufacturing gas was more by £2217; while the distribution charges for the year were less by £380. The total expenditure for the year was more by £2257. The revenue from sales of gas increased by £1265; and that from residuals was less by £565. The total revenue for the year was up by £544; but the gross profit decreased by £1713, and there was a net loss of £1549.

Mr. H. H. Robbins remarked that the gas sold for motive power was 50,489,300 cubic feet, or one-third of the total consumption; and yet the profit on this quantity was only £210. They could see the position of the gas-works that day; and he maintained that they would be in the same position at the end of next year, if there was nothing done with regard to the price of gas for motive power, which ought, in his opinion, to be increased. They were spending £2000 at present on a water-gas plant, absolutely for the benefit of motive power users, to whom they were selling at a profit of only 1d. per 1000 cubic feet. If they had only the ordinary consumers to cater for, there would, he urged, be no necessity to go to the expense of erecting a new holder at a cost of £6200. The Gas Committee never had a better chance than they had now of increasing the price for motive power purposes. As most of the local works were busy on war supplies, he did not anticipate any difficulty in getting an advance. There had been a reduction in the quantity of gas sent out for the past month of 529,000 cubic feet; and there would be a further decrease next year, because they had lost the Rowley contract, under which 7,000,000 cubic feet of gas per annum was taken. It was, he considered, time something was done to make the undertaking pay. It had been a "bugbear" to the town since it was started; and it was going to be a serious matter for them unless

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something was done to put the concern on a proper business footing by charging more for motive power gas.

Mr. Davies asked if the charges for motive power were based on the old list of 1s. 8d. per 1000 cubic feet, or upon the new one of 2s. 4d.

Mr. Jackson said the charges were made upon the old list, as the price had only recently been raised.

Mr. Davies: So we can look forward to £1000 increased revenue from this source next year.

Mr. Robbins: But you have got a 6d. increase on the coal; and whatever happens there is only 1d. per 1000 feet profit on the motive power gas.

Mr. Wallace said there was a loss on the year's working of about £2000, which would have to be made up from the reserve fund. Some time ago their reserve fund stood at £10,000; but it was now only £3000. They ought to pay attention to this matter.

Mr. Jackson said if they put against the loss on the year the sum of nearly £800 allowance in respect of public lighting, and £800 paid out of revenue in regard to the new holder, the position was pretty nearly brought level.

Ultimately the accounts were adopted.

SUCCESS OF NEW WORKS AT BRIDGWATER.

A slight decrease in the sale of gas for the year ended June 30—chiefly attributable directly and indirectly to the restrictions imposed on both public and shop lighting during the early months of this year—was reported by the Directors of the Bridgwater Gas Company at the recent annual meeting. In order to secure adequate supplies of coal, a very serious advance in the contract prices for the current year has had to be paid; and to meet this additional charge and the increased cost of all other materials, the Directors have found it necessary to advance the price of gas 6d. per 1000 cubic feet. Of the staff and workmen, 35 per cent. have joined His Majesty's forces since the outbreak of war. The Directors thought it right to make allowances to their dependants. An opportunity having presented itself to acquire commodious property on lease in the centre of the town, the Board decided to acquire it, and to remove their present offices and show-rooms. The balance of the net profit for the year was £3464, which, added to the amount brought forward, and bank interest, made a total of £4369. Interim dividends and debenture interest had been paid, and there remained a balance of £2283 to be dealt with. The Directors recommended the payment of final dividends for the year of 5 per cent. on the "A" stock (making 10 per cent. for the year), 2½ per cent. on the "B" stock (5 per cent. for the year), and 2½ per cent. on the "C" stock (5 per cent. for the year). This would absorb £1775, and leave a balance of £508 to be carried forward. The Chairman (Mr. R. Y. Foley) said he was sure the proprietors would agree that the accounts were of a most satisfactory character. The new works lately erected continued to give unqualified satisfaction; and the results had exceeded their expectations—the make of gas per ton of coal and oil equivalent having increased from 9500 to 11,675 cubic feet. This success had reflected itself in the employees' bonus, which last year amounted to the very handsome sum of 9 per cent. on their wages, in addition to which all the workpeople had been given a war bonus of 1s. per week on their wages. The erection of the new retort-house, though only in substitution for an older building, had been eagerly seized upon by the authorities as an excuse to raise the assessment of the works from £1100 to £1400, which on appeal had been reduced to £1325. This additional taxation, combined with an increased cost in almost every other direction, added to the working expenses. On the top of this came a 6s. per ton advance in the price of coal, representing something like £2250 a year to the Company, necessitating an advance in the price of gas. It was not likely much relief would be secured by the Coal Prices (Limitation) Act. In the early months of the year, the streets were, by official orders, suddenly plunged into gloom, through fear that their brilliant illumination might attract the undesirable attentions of passing Zeppelins. This diminution of public and shop lighting had a considerable effect on the sale of gas. The restrictions so hastily imposed were, however, as hurriedly withdrawn—it was believed by a hint from headquarters that in localities where it was reasonably safe to do so the consumption of gas should be encouraged, so as to augment as much as possible the production of toluol. If there was any truth in the rumour that, in pursuit of economy, the local authorities intended to put out every second street-lamp during the coming winter, any such step would lessen the Company's production of toluol. Every encouragement should be given to the production of gas, thus increasing the quantity of high explosive material so much needed. In connection with the manufacture of toluol, the Government expert who frequently visited their works described the results as excellent. From every ton of coal carbonized sufficient toluol was being extracted for 3½ 3-inch high explosive shells; so that something like 26,300 shells might be taken as being supplied with high explosive from their works in a year. The Chairman congratulated Mr. J. H. Cornish (the Manager and Secretary) on the results he had achieved; remarking that in his work he had been loyally assisted by his son and the other members of the staff.

Salford Corporation and Sale of Sulphate of Ammonia.—The Gas Committee of the Salford Corporation are reported to have accepted an offer of Messrs. Brunner, Mond, and Co., Limited, of Northwich, to purchase the sulphate of ammonia produced at the gas-works for so long a period as they require it for the manufacture of materials on behalf of the Government, at the average price of sulphate of ammonia, in single bags, f.o.b Liverpool, as certified by Messrs. Bradbury and Hirsch, after deducting 2½ per cent., with an allowance off such price of 8s per ton—subject to the price for each month's deliveries being based on the average price for that particular month.

CONVALESCENT CAMP, EASTBOURNE, fitted throughout with Arden Hill's Gas Apparatus.

Interior of one of the five cook-houses, each of which is fitted throughout with

Gas-Heated Apparatus for Cooking, Sterilising, and Hot-Water Supply.

Manufactured by
ARDEN HILL & CO.,
"Acme" Works,
BIRMINGHAM.

WINDSOR WATER SUPPLY.

A New Filter Installation.

A system of bacterial purification has just been adopted to ensure he purity of the water supply to the borough of Windsor, as also to ton—including the College, and the troops in the district. The in-tallation was formally put into operation in the presence of the Mayor nd Corporation—with the Borough Surveyor and Water-Works Engi-eer (Mr. E. A. Stickland) and the Medical Officer of Health.

Prior to the opening ceremony, the Mayor (Mr. Councillor W. Carter) ntertained the assembled company at luncheon ; and in the course of is speech referred to the courtesy of the Reading Corporation in ermitting the Windsor Corporation to investigate the Candy filtration ystem (which they had adopted) as used by the town with such uccess. The Chairman of the Reading Water-Works Committee (Mr. lderman T. B. Parfitt), in an interesting speech, described the Read-ng Water Supply (which is taken from the navigable River Kennet) nd set forth the reasons that led them to adopt the "Declor" filters or his town.

The installation at Windsor consists of six of these pressure filters—ach 8 ft. 3 in. internal diameter by 18 feet high—constructed of mild teel plates to withstand a working pressure of 100 lbs. to the square nch. The water supply for Windsor is obtained from wells on Tan-ier Island—the water being pumped by hydraulic or electric power, s the case may be, into the mains. The water, however, does not ow go direct into the mains from the pumps, but is diverted, so that first passes through the filters. A low-pressure turbine placed in the 2-inch pipe leading to the filters is so constructed that its speed of otation is proportionate to the volume of water passing at any given me. A small ram-pump (provided in duplicate) is worked from a ountershaft driven by the turbine; and this pump is continually in-ecting into the water passing to the filters, a solution of calcium hypo-hlorite, so that the water receives its correct dose of free chlorine. he solution of calcium hypochlorite is contained in a small tank, and he ram-pump draws direct from the solution tank, which is also in uplicate.

After its chlorination the water flows along the filter mains, and sub-ivided by branches passes equally into the filters, each of which is rranged for dealing with up to a maximum of 8000 gallons per hour ; o that the installation is capable of coping with well over a million allons per 24 hours. The treated water enters the filters at the top, nd, after passing slowly down through them, flows through branch ipes from the bottom into a branch main, and thence to the town. he upper part of each filter contains a bed of silica sand and gravel, vhich serves as a protecting layer to the dechlorinating bed placed in he lower part. In addition to containing the silica bed, the upper nd middle part of each filter is arranged to act as a contact tank ; so hat the free chlorine remains in contact with the water for half an hour—from the time of entering the filter to the time the chlorine is eliminated. This elimination takes place in the dechlorinating bed in the lower portion of the filter. The active dechlorinating agent is a special granular insoluble carbonaceous material which rests upon graded layers of silica, supported, like the silica sand bed, on a perforated floor.

The filter contains sufficient of the dechlorinating material to last for a year's working ; and, when fresh material is required, the old can be readily removed (through manholes provided for the purpose), and fresh material put in its place—an operation that can be performed in a few hours.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The accounts of the Gas Department for the year ended June 30 and the estimates for the current year were considered at the last meeting of the Greenock Corporation. Much satisfaction was expressed at the successful results of the past year—ending, as it did, with a net surplus of £1582—and it was agreed to give the Engineer and Manager (Mr. James Macleod) an honorarium of £50, as an appreciation of his working of the department. The estimates were adopted ; and the price of gas was increased 5d. per 1000 cubic feet to consumers by ordinary meters and 4d. to consumers by slot-meters, making the charge 2s. 11d. to ordinary consumers and 3s. 4d. to slot consumers. Rebates of 10 per cent. on accounts of £100 and over and of 20 per cent. in special cases were unaltered. Some figures from the report are as follows : Gas sold and accounted for 1910, 300 millions ; 1911, 316 millions ; 1912, 360 millions ; 1913, 383 millions ; 1914, 404 millions ; 1915, 426 millions. An increase of 22 million cubic feet for the past year over the previous year is shown. The number of gas appliances out on loan during the past year was 11,053 ; being an increase of 1221 over the previous year. The number of consumers still increases, though last year shows the smallest increase for half-a-dozen years back. In 1909, there were 14,052 consumers ; and at 1915 the total was 16,555—an increase of 2503 over this period. The amount of coal carbonized last year was 43,018 tons ; the make per ton being 10,232 cubic feet, and the gas sold and accounted for 9903 feet—an increase of close on 400 feet over the previous year. The unaccounted-for gas was 3·21 per cent., as against 3·45 per cent. the previous year. The new plant is now complete, with the exception of the gasholder, which is not expected to be ready until the spring of next year. The whole of the gas required is being made in the Woodall-Duckham vertical retorts.

At a meeting of the Annual Committee of the Convention of Royal Burghs, held in Edinburgh last Wednesday, the Agent read the reply from the Scottish Office as to the resolution of the Committee suggesting the suspension of the sinking funds and the depreciation fund pro-

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Silent, Keen Flames. Who **Discovered** the way to produce Silent, Keen Flames, adding to the popularity of Gas Fires ?

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WILSONS',

Like **Colombus** among Explorers, they stand on a pinnacle unrivalled as the Pioneers of the Gas Heating World.

Wilsons' Lead ! Others Follow !

visions of the Burgh Gas Supply (Scotland) Act, 1876. The Chairman (Ex-Provost Keith) said that the Scottish Office not only deprecated the suspension of sinking funds, but also any modification of the statutory obligations as regarded the depreciation fund. Mr. Alexander Morrison (Bridge of Allan) moved to the effect that: "The Convention, on reconsideration, express its agreement with the views of the Secretary for Scotland as to the desirability of gas authorities complying fully with the provisions of section 41 of the Burghs Gas Supply (Scotland) Act, 1876, so far as relating to the depreciation fund obligations of gas undertakings. But, while cordially concurring with the Secretary for Scotland that, as a general principle, all statutory obligations in relation to sinking funds and depreciation funds should be fully met as they arise, agrees that, in the public interest, the sinking fund provisions of the Burghs Gas Supply (Scotland) Act, 1876, and the corresponding provisions of other Acts of Parliament under which gas undertakings are administered, should be suspended for the duration of the war, and until the first term of Whitsunday occurring not earlier than one year after the close of the war, and resolves to press this view on the Secretary for Scotland with the object of getting him to initiate legislation on the subject." The Assessor for Stirling seconded. On a vote, however, the previous question was carried by a large majority.

Gas engineers in Scotland are following with great interest a development of the gas industry which has taken place at Akkrum, in Friesland, where peat mixed with coal is being used for the manufacture of gas of a very high quality. It was found that the retorts became too hot with peat alone, because of the great amount of steam generated. The proportions used are two parts of coal to one of peat; but it is possible that further experience may lead to the reduction of the quantity of coal at present necessary. Peat is plentiful in Scotland.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Oct.* 11.

The value of pitch remains unaltered at the figure last recorded. Export business is most difficult to arrange, although buyers seem inclined now to take a more reasonable view of the situation. Creosote is firm at 4½d. per gallon, net, in bulk. Solvent naphtha continues in good demand; the value being 2s. 1d. per gallon, in bulk, at makers' works.

Sulphate of ammonia is firm at £14 8s. 9d. per ton, net and naked, at makers' works, for 25 per cent. quality.

Tar Products in the Provinces.

Oct. 11.

Markets for tar products remain fairly steady. There is very little business doing in pitch, and makers are more reasonable in their idea of value. The article has been offered at 20s. per ton f.o.b. without finding buyers. Creosote is still quiet, and is difficult to sell. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 20s. to 24s. Pitch, East Coast, 20s. to 21s. per ton; Norfolk, Suffolk, and Humber ports, 19s. to 20s.; West Coast, 19s. to 20s. Manchester; 20s. to 21s. Liverpool; 20s. to 21s. Clyde. Benzol, 90 per cent., North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅞d. to 3d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 5d. to 3s. 6d. Naphthalene, £18 to £25; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Oct.* 9.

Throughout the week there has continued to be a good demand for this material, and all parcels offered for sale have been readily absorbed at advancing prices, although the purchasing has again been mainly confined to dealers. Closing quotations are £14 15s. per ton f.o.b. Hull, £14 17s. 6d. f.o.b. Liverpool, and £15 f.o.b. Leith, for early delivery. There has been more inquiry in the forward position; but the views of makers have largely stood in the way of business. It has transpired, however, that several transactions have taken place at £15 2s. 6d. per ton at the ports for October-March delivery.

Nitrate of Soda.

This market has remained very firm at 13s. 6d. per cwt. for ordinary, and 14s. 6d. for refined quality, on spot.

Sulphate of Ammonia.

From another source it is stated that the market for this article has remained fairly steady throughout the past week, and at some ports the prices paid are an improvement. Outside London, makes are quoted at £14; Hull, £14 7s. 6d. to £14 10s.; Liverpool, £14 10s. to £14 12s. 6d.; Leith, £14 15s.; Middlesbrough, £14 10s. to £14 12s. 6d.

Public Lighting Charges at Doncaster.—The following practical recommendations have been made by the Doncaster Lighting Committee, as a result of considering the method of charging for public lighting under existing abnormal circumstances: (*a*) Where lamps are left unlighted, a charge of 10 per cent. on the capital value of same to be made to cover interest and standing charges; and (*b*) where lamps are partly used, the fixed charge to be made, less the estimated cost of gas and material saved, but *plus* 5 per cent. on the value of the lamp.

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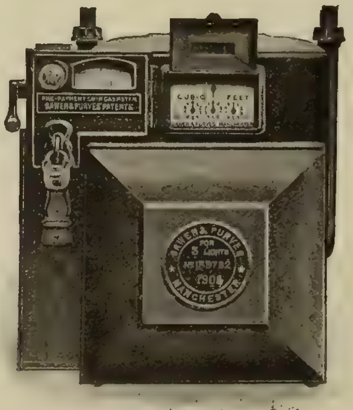

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COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is rather more active; and the output for the rest of this month seems to be well booked-up, both of steam and gas coals, while the prices are steadier. In the steam coal trade, there is a brisk inquiry; and for best Northumbrians from 18s. 6d. to 19s. per ton f.o.b. are current rates. Second-class steams are firm at 16s. 6d. to 17s. per ton; and steam smalls are little altered at 11s. to 14s. per ton f.o.b., according to quality. The output is fair, when the lessened number of miners at work in the collieries is borne in mind, and it is met by a good export need. The shipments of coal, home and foreign, from the local ports—the Tyne and to West Hartlepool—have averaged over the last month some 66,000 tons per working day for all kinds of coal. In the gas coal trade the demand is brisk; and as it is likely to improve for the rest of the year, the tendency of prices is stiffer. Best Durham gas coals are 19s. to 19s. 6d. per ton f.o.b.; second-class gas coals are 16s. 6d. to 17s. per ton; and "Wear Specials" are firm at 20s. to 21s. There is some variation in forward prices for gas coal; but the contracts for the Paris Gas-Works are now believed to be arranged for the whole of next year, for some 300,000 tons of Durham gas coals, at prices that are from 17s. to 19s. per ton f.o.b., according to quality. Freight for gas coals is at present shown by figures at 9s Tyne to London, and 17s. to 17s. 6d. Tyne to Rouen. There is a good inquiry for coke; but shipments are not so easy to arrange to some Continental ports that are good customers usually. Gas coke is steady, though the production is increasing—good makes being 28s. to 30s. per ton f.o.b. the Tyne.

It was announced on the Newcastle Commercial Exchange last week that the Paris Gas-Works had confirmed the order for the purchase of just over 250,000 tons of Durham gas coals for delivery next year, at 19s. per ton f.o.b. for "Wear Specials," and 17s. and 17s. 6d. for best seconds.

* * *

Coke for Cooking.—In a lecture on "Economy in Cooking," delivered at the Institute of Hygiene last Friday, Mr. Herman Senn, G.C.A., said there had never been a time when the art of cooking was more important than now. Economy in cooking comprised two things—the knowledge of food values and the power to substitute a less costly food for the more expensive (always with a due regard to obtaining a properly balanced nourishing meal), and the economy of fuel. As a nation, we had much to learn concerning the principles of applying fuel. Professor Bone had declared that one of the greatest and most urgent problems after the war would be that of fuel economy. Economy of fuel depended upon two qualities—intelligence and an infinite capacity for taking pains. The thing to aim at was slow deliberate cooking. More use should be made of coke and charcoal, which were admirable fuels for slow cooking.

Commercial Motors and the Petrol-Tax.

The Commissioner of Customs has informed a deputation of the Commercial Motor Users' Association that Mr. M'Kenna has introduced into the Finance Bill a clause to secure a 50 per cent. rebate of the new petrol-tax to all commercial motor users who have previously been exempt to the extent of 1½d. a gallon when the full tax was 3d. a gallon.

Technical Instruction in the Gas Industry.

At to-day's meeting of the London County Council, the Education Committee will report as follows: "The Board of Education have forwarded to the Council a report on technical instruction relating to the gas industry in the London area, which deals with the extent to which use is made of the existing provision for technical instruction in the subject, and with the efficiency of the instruction given at certain institutions, and makes suggestions for the training of gas-fitters' apprentices and students of gas engineering and manufacture The report does not call for any special action on the part of the Council at the present time, except in regard to the directions in which future developments should take place. We understand that there is always a dearth of competent gas-fitters; and any schemes of technical training likely to improve the general efficiency are, therefore, most desirable. A conference has been held between the Council's officers and representatives of the Institution of Gas Engineers; and we have had before us the views of the Advisory Committees and governing bodies of various Institutions interested in the matter. Detailed proposals for classes in gas-fitting for both junior and senior students will be considered in connection with the arrangements for session 1915-16."

* * *

An Unlighted Town.—Athy (co. Kildare) is to be without its usual public gas lighting this season, owing to the action of the Urban Council, who have now decided that it is "better to economize," in view of the fact that the Gas Company have raised the price from 5s. to 5s. 5d. per 1000 cubic feet on account of the increased cost of coal. A proposal that the lamps should be lighted on a division of the extra 5d., was not seconded.

Tees Benzol Syndicate.—The Tees Benzol Syndicate, Limited, has been registered, with a nominal capital of £100 in £1 shares, to manage certain works on behalf of His Majesty's Minister of Munitions, to carry on the business of colliery proprietors, steel makers, manufacturers of chemicals and bye-products produced from coal, &c., and to adopt an agreement with the Minister of Munitions. The Company is a private one; and the first Directors are Sir Hugh Bell, A. J. Dormans, A. F. Pease, J. H. Pease, W. L. Johnson, and G. B. Nancarrow. It is stipulated that no person other than the original subscribers shall be registered as a member of the Company who shall not have been previously approved in writing by the Minister of Munitions or his deputy.

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Price of Gas at Wilton.—At last week's meeting of the Wilton Town Council the Gas Committee reported that the price of gas had been increased by 6d. per 1000 cubic feet, and that users of slot-meters would in future be charged 1s. a quarter for the use of the meter, in order to equalize the charges.

Street Lighting Complaint at Bradford.—The Bradford Technical Education Sub-Committee have decided by resolution to inform the Chief Constable that they consider the present street lighting unsatisfactory, and to request that arrangements should be made for improved lighting where necessary. The dark streets, they point out, have a serious effect upon attendance both at evening schools and classes, and consequently—owing to loss of grant from the Board of Education—upon the Committee's finances.

Lighting of Carrickmacross.—A new Company has been formed for public and private lighting in Carrickmacross (co. Monaghan). The capital is to be £6000; and the local gas-works and an electrical installation are taken over. The gas-works, mains, &c., are valued at close on £4000; and the plant is in great part new, having been renewed during the past three years. The general management will be under Mr. William Steele, Consulting Gas Engineer. The revenue of the old Company for some years past is stated to have been £800 per annum.

Gas-Works and the Labour Supply.—Owing to the large number of men who have joined the Colours, the high rates of wages paid to workers by manufacturers of munitions, and abnormal demands for gas by factories turning out warlike commodities, Sir Hallewell Rogers (the Chairman of the Gas Department), stated last week that, while there is no need for alarm, it is most desirable that economy in the use of gas should be exercised by the citizens of Birmingham. The output of gas, chiefly for munitions work, has increased by leaps and bounds, beating all previous records. The percentage of increase is over three times as large as for the corresponding period of last year; and the summer output was nearly equal to the previous winter output. In consequence of the reduced staff, it will be quite impossible to fix gas fires and cookers at the ordinary rate. The Gas Committee communicated with all the other departments of the Corporation, asking them not to dismiss workmen of whose services they are not in need without communicating with them. The Gas Department are anxious that all suitable men should be transferred to the gas-works.

The Best Form of Heating.—In the course of his lecture at the Institute of Hygiene last Wednesday, in connection with the exhibition and conference on lighting, heating, and cooking, Dr. R. King Brown, taking for his subject "Heating and Health," said that in choosing a form of artificial heating, it was wise to follow Nature as much as possible. Thus, the most healthy form of heating was by radiation combined with light, in imitation of the sun; and the best form of such heating was the much-abused open fire, albeit combined with the most modern improvements. It was often complained that a fire only warmed one side of one, while freezing the other. In this it was like the sun, and promoted movement which, with the consequent change of temperature, was natural and healthy. The great evil of the open fire was the amount of smoke belched into the atmosphere, which was the whole cause of the London fogs. The person who could invent a stove which would consume its own smoke would have conferred a great boon on humanity. The form most nearly approaching the ideal of natural heating was the improved fire, coke or gas, combining radiant heat and light with proper ventilation.

Halifax War Savings Committee.—Reporting to the Halifax Town Council on the question of war savings, Alderman Whitley Thomson pointed out that some months ago the Gas Committee withdrew a proposal for a capital expenditure of £50,000 for re-organizing the gas-works. Originally the Corporation had borrowing powers for various works amounting to £172,000; but at the request of the Treasury, this had been cut down to the extent of £47,000. Therefore, practically £100,000 of capital expenditure had been postponed. In regard to revenue, the war bonus to employees would come to about £4200 per annum, and the allowances made to employees serving with His Majesty's forces to nearly £10,000 a year. But for the war, he did not think there was any doubt there would have been a very good prospect of a considerable reduction of the rates next year; but owing to the war and the tightness of money, he could not hold out the slightest hope of any reduction. He was only afraid there might be an increase. The War Savings Committee appointed by the Council a month ago had arranged for a saving amounting to £6580 on the estimates for the current year. Nothing could have been more satisfactory than the action of the Committees in this matter. Other economies were suggested, and would be considered. He was assured that practically no reduction of labour would result from these economies, because the staffs were already much depleted.

Chester Gas Company's Profit-Sharing Scheme.—The Profit-Sharing Committee of the Chester United Gas Company, in their report for the past twelve months, say that on June 30, 1914, the price of gas was 2s. 6d. per 1000 cubic feet, at which rate profit-sharing employees were entitled under the regular scale to a bonus of 7½ per cent. on their salaries or wages; but the Directors found it necessary to increase the price of gas from March 18 last to 2s. 11d.; and at this price the bonus to which the employees were entitled under the scale was only 5 per cent. In accordance with the recommendation conveyed in the last report, employees who signed profit-sharing agreements for the current year waived the right of bonus according to the profit-sharing scale and rules; and it is therefore gratifying to the Committee to report that, while the Directors have expressed their appreciation of the confidence thus displayed in them by the employees, they have allowed the bonus to be declared at the rate of 6¼ per cent., which is at the full rate provided under the profit-sharing scheme. The Directors have granted to those profit-sharing employees who are serving in His Majesty's forces a bonus on the same basis as if they had continued in their ordinary employment in the Company's service. Withdrawals during the past year have been heavy; and it is hoped there will be a marked change in this respect during the coming twelve months. During the past year employees have taken up a further sum of £280 of the Company's ordinary stock, making an aggregate sum of £2130 of stock purchased by them under the scheme.

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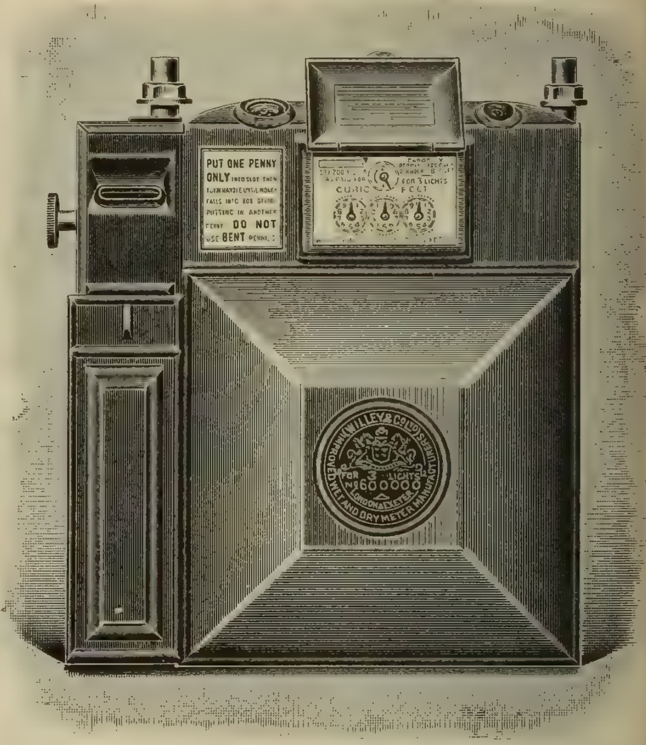

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Price of Gas at Pontefract.—The Pontefract Town Council last Vednesday decided to advance the price of gas 3d. per 1000 cubic feet; he new charge being 3s. 2d.

Lurgan Gas-Works Purchase Postponed.—At the last meeting of be Lurgan Urban Council, the Chairman intimated that the Treasury iad withheld consent to the Council borrowing £50,000 for the purhase of the gas-works, which were to have been taken over on the st inst. by the Council. Arrangements were accordingly being made vith the Directors of the Gas Company to continue operating the vorks for the present.

Darlington Gas-Works Accounts.—The working statement of the Darlington Gas Department for the year ended March 31 last shows hat from 38,065 tons of coal, 433,246,000 cubic feet of gas were made, or 11,381 feet per ton of coal. The proportion of unaccounted-for gas was 4·75 per cent. The net cost of gas per 1000 cubic feet sold was 1s. 5·365d.; and a gross profit resulted from the year's operations of £14,532, or 6·43 per cent. upon the total capital employed. Private consumers (numbering 15,114) took 95·25 per cent. of the total quanity of gas sold. Coke and breeze saleable amounted to 9·8 cwt. per on of coal carbonized.

To Economize in the Use of Coal.—The Parliamentary War Savings Committee have prepared a leaflet, entitled "Save Your Coal," containing twelve hints, among which are the following: Use gas coke wherever possible instead of coal. Coke made in coke-ovens is not suitable for house-fire purposes. Coal and coke mixed in equal proportions give a fuel which will last longer than coal alone. The more coke is used, the greater will be the production of the bye-products which are required for making explosives for the army and navy. Use gas whenever possible for cooking purposes, and turn it off when done with. By using gas, you economize in coal, and at the same time are assisting in the further production of bye-products in the gas-works which are necessary for the production of certain explosives now argely being used in the war.

Wages Questions at Wallasey.—Discussion took place in the Wallasey Town Council last Thursday, regarding proposed increases of wages in the Gas Department. In the first place, a recommendation of the Gas and Water Committee to give the lamplighters of the town an increase of 1s. per week was referred back for further consideration. Another proposal of the Committee was that the wages of the men at the gas-works should be increased so as to put them on the basis of the Birkenhead men, as fixed by a recent award—the proposed increase representing a total of about £600 per annum. It was moved that the consideration of this matter be deferred for twelve months, on the ground that many of the employees "were not making any sacrifices in regard to the war, and were better off than numerous other people, as they did not pay income-tax and had no position to keep up." It was pointed out that the increases were recommended after full consideration by the Committee; and the Council agreed to them—only three votes being recorded for the amendment.

Ilkeston Gas Charges.—At last Tuesday's meeting of the Ilkeston Town Council, Mr. W. Smith, in accordance with notice, moved that the question of the methods adopted in the collection of gas charges, since the price was recently advanced, should be referred to the Gas Committee for consideration and report. He alleged that an attempt had been made to charge the increased price to some consumers for the quarter previous to that for which the increase was determined upon; and that since this date some had been charged the enhanced rate for half the quarter only, while others, including some members of the Council, had been charged the old rate for the full quarter. The Mayor (Mr. T. A. Macdonald), who is Chairman of the Gas Committee, stated that only one complaint had been made at the office; and it had been found that there was no justification even for this. The Committee were quite willing to accept Mr. Smith's resolution. Nothing of a deceptive or underhand character had been done in dealing with those who used slot-meters; and no complaint had been made to him. The resolution was adopted.

GAS COMPANIES IN THE STOCK EXCHANGE.

Business last week on the Stock Exchange was quite upon what has now become the normal standard of quietude; but, taken on the whole, the ruling tone was agreeably firm. It is true that a temporary check was administered in the middle of the week by the dramatic and unexpected Greek crisis; but a quick recovery supervened and established an improvement, which bore eloquent testimony to the calm strength of the markets. A very gratifying feature was the increasing firmness of the War Loan, the popular demand for which was most marked. Colonial issues maintained their strength; and here the assured fine harvest of Canada, and the bright prospects of the Australian yield, lent potent support. The American was another good market; and Japanese was a bright point in the Foreign. Dulness prevailed in our much-tried Home Rails, and South Africans were easier; while movements varied in the Miscellaneous category. Glancing at our friend the enemy's financial affairs, it may be noted that in New York the German War Loan was being offered at a 7 per cent. price—an awkward come-down after all the cock-crowing in Berlin. In regard to our minimum prices, urgent request for some reduction continues; and it is likely that something in this line may be done. Some disappointment was manifested at the passing of an interim dividend by the Stock Exchange Managers; but looking at the serious reduction of revenue, it is difficult to blame them. Business in the Gas Market fell away considerably in point of volume—only seven undertakings were dealt in at all. As a general rule, prices were unchanged. The Money Market was easier.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 77¾, 78½, Primitiva 2⅛, South Metropolitan 76¾, 77¼, 77½. On Tuesday, Primitiva 2, ditto preference 3$\frac{5}{16}$, 3⅜, South Metropolitan 77¼. On Wednesday, not a single bargain was marked. On Thursday, British 36¾, 37, South Metropolitan, 77¼, 77½. On Friday, Alliance and Dublin debenture 69½, Brentford "B" 85½, 86, Gas Light ordinary 78, 78½, Primitiva preference 3⅜, 3$\frac{15}{32}$, South Metropolitan 76⅜, 76½, 77, 77¼, South African, £8 4s.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING OCT. 9.

ue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
1,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59—64	3 18 2	..
4,000	"	July 10	4	Do. 4 p.c. Deb.	76—79	5 1 8	69½
0,000	5	April 29	7½	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
0,000	10	Feb. 26	16	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
3,480	10	"	7	B 7 p.c.	15—15½	4 10 4	..
5,000	10	"	6	Pref. 6 p.c.	13½—14	4 5 9	..
—	—	—	—	Deb.	..	—	..
0,000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	5 5 8	.
0,000	"	"	11	Do. New	204—209	5 5 8	85½—86
0,000	"	"	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
6,250	"	June 11	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
17,880	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	5 8 4	..
4,200	"	"	8	Do. A Ord. Stk.	154—159	5 0 8	
0,000	20	Mar. 26	12½	British	44—45	5 11 1	36¾—37
0,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
5,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
0,000	10	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
0,000	10	—	—	Do. 4½ p.c. Pref.	4—6	—	..
0,000	Stk.	June 26	4½	Do. 4½ p.c. Deb.Stk.	70—75	6 0 0	..
7,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
13,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
0,000	"	"	5¼	Do. 3½ p.c. do.	103-105	5 1 6	..
75,000	"	June 11	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	..
00 000	Stk.	"	4	Continental Union, Ltd.	76—79	5 1 8	..
00 000	"	"	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
—	—	—	—	Croydon B and C 7 p.c.	..	—	..
2,270	Stk.	—	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	"	—	4	Do. Deb. Stk.	102—104	3 16 11	..
02,180	10	July 29	10	European, Ltd.	17½—18	5 11 1	..
61,910	Stk.	Feb. 12	4/17/4	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	77¾—78½
00,000	"	"	3½	3½ p.c. max.	76—79	4 8 7	..
62,235	"	"	4	4 p.c. Con. Pref.	96—99	4 0 10	..
74,850	"	June 11	3	3 p.c. Con. Deb.	72½—74½	4 0 6	..
30,000	"	"	10	10 p.c. Bonds	..	—	..
158,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
—	—	—	—	Hornsey 7 p.c.	..	—	..
81,000	Stk.	Mar. 12	7⅞	Ilford A and C	151—154	5 2 4	..
65,780	"	"	6⅜	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
40,000	Stk.	May 14	9	Imperial Continental	150—160	5 12 6	..
235,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
300,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7	B	146—14	4 14 7	
306,088	..	June 26	4	Do. 4 p.c. Pr. Deb.Stk.	..	—	..

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
75,000	5	June 11	6	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	Monte Video, Ltd.	11½—12	6 18 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	Ottoman, Ltd.	7¼—7¾	6 9 0	.
60,000	50	Feb. 26	13	Portsea, Island B	128—131	4 19 8	..
100,000	50	"	12	Do. C	118—121	4 19 2	..
52,000	50	"	10	Do. D	..	—	..
249,980	5	April 29	0	Primitiva Ord.	5½—6	6 18 4	2—2⅛
499,960	5	June 26	5	" 5 p.c. Pref.	4¾—5	5 0 0	3$\frac{5}{16}$—3$\frac{15}{32}$
521,600	100	June 2	4	" 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	" " " 1911	..	—	..
846,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	Sheffield A	223—224	4 9 8	..
209,984	"	"	10	Do. B	222—224	4 9 8	..
528,500	"	"	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	South African	10½—11½	7 16 6	8/4/0
6,429,895	Stk.	Feb. 12	5/4/0	South Met., 4 p.c. Ord.	111—113	4 16 8	76⅜—77½
1,895,445	"	July 10	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	..	"	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
—	—	—	—	Do. West Kent.	..	—	..
187,058	"	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	Tottenham District A 5 p.c.	136—138	5 8 8	..
742,275	"	"	6	B 3½ p.c.	115—117	5 2 7	..
181,255	"	June 26	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
				Wandsworth, Wimbledon, and Epsom			
80,000	Stk.	Feb. 26	8⅝	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/8	" C 3½ p.c.	110—115	5 2 0	..
852,000	"	"	6¼	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	"	"	6⅝	Epsom 5 p.c.	121—126	5 5 2	..
88,416	"	June 26	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

Mr. Walter Hoe, late Manager for the Ecliptic Gas Light Company, of Nuneaton, has been appointed Northern Representative for Messrs. Arden Hill and Co., of Birmingham.

Mr. Baldwin Latham, the Engineer to the Abertillery and district water-works, now under construction, in the course of a report, comments upon the continuous delay in the carrying out of the contracts, and says that, in order to attract more labour, higher wages and a bonus should be offered.

On retiring through ill-health from the position of foreman, after 38 years' service with the West Bromwich Corporation Gas Department, Mr. G. Lines has been presented with an armchair, subscribed for by the staff and the men at the works. Mr. W. H. Johns (the Engineer), in making the presentation, referred to the highly satisfactory manner in which Mr. Lines had carried out his duties during his whole career at the works.

Holophane Limited have just issued a new illustrated handbook, comprising a series of reproductions of photographs of actual lighting installations made with their system of illumination. The book is divided into sections according to the class of building dealt with; and its object is to show that the Holophane system is capable of being adapted to any kind of building or style of architecture. In glancing through the book, one of the photographs noticed is of the Board-room of the South Metropolitan Gas Company. It is pointed out that, although Holophane glassware is often chosen on account of its scientific design, and because of the economies it achieves, the appearance of the units is also an important consideration. In the lighting of fine interiors, it is, of course, necessary to select fittings and glassware which harmonize with the general scheme of decoration, and have a dignified and impressive appearance. Its qualities in this respect have led to Holophane glassware being widely used in many important public buildings and interiors of architectural distinction.

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Appointments Vacant.

Fitters. No. 6106.
Assistant Superintendent. No. 6105.
Testers (Gas-Fires, &c.). No. 6107.
Engineer. South-West Suburban Water Company. Applications by Oct. 20.

Appointments Vacant *(continued)*—

General Works Foreman and Outdoor Foreman. Stockton-on-Tees Gas Department. Applications by Oct. 19.

Appointment Wanted.

Clerk and Collector. No. 6108.

Process Wanted.

Naphthalene Separation and Refining. No. 6104.

Plant, &c., for Sale.

Cast Iron Lamp Standards. Glastonbury Gas-Works.

TENDERS FOR

Fire-Clay Goods.

Sheffield Gaslight Company. Tenders by Nov. 2.

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VOL. CXXXII., No. 2736.] TUESDAY, OCTOBER 19, 1915. [67TH YEAR.

EDITORIAL NOTES.

Toluol—Work for the Maximum Yield.

THE attention of every engineer and manager of every gas-works, large and small, in the United Kingdom is asked to certain considerations affecting the application of the "C" process to the washing of gas for the recovery of toluol; or this is a matter that to-day is (we may almost say) of paramount importance to the victory of this country and its Allies in the great war. This is a point that cannot be too trongly insisted upon. The war is absolutely one of explosives; and the country that can produce the largest quantity of the bases for the manufacture of explosives is he one that is going to show most material effect in bringing about a decisive issue. This point being well appreciated, t follows that every drop of toluol that gas-works can produce strengthens the position of this country, and places t in a stronger position to help to bring about that ending which is the desire of all loyal Britishers—among whom he gas engineers of the country stand second to none. Their loyalty in the present can be best testified by the work that s put into the recovery of toluol and benzol with the view to ecuring the maximum under the conditions of their works. Gas undertakings, as a matter of fact, can be looked upon as ndispensable factors in the war, by reason of their opportunities for extracting the requisite and invaluable raw materials from their gas—indeed, they are much envied by many other industries for their pre-eminent position in serving he country in the days of its greatest need.

What, therefore, it is desirable should be made abundantly lear is that there is no such thing within sight as getting a larger quantity of ingredients for explosive purposes than will atisfy requirements. Any gas engineer, working the "C" process, who takes the trouble to supervise the details, so as o get even a little more of the valuable necessaries for the making of explosives, is doing a good work for his country. n fact, we would place the matter higher than that, and ppeal to every officer in charge of the process to look upon as an individual responsibility to increase to the utmost he available supply of what is needed. It is acknowledged hat there has been great encouragement by the way gas ngineers have taken this work in hand, and by, generally peaking, the remarkably good results that have been attained. But these good results have not been uniformly realized from the same coal and with carbonizing systems pproximately in similar condition and worked in like manner. Coal and carbonizing systems and working methods re, of course, all factors in the matter of yield of the needed ubstances; but we do urge—and that with all earnestness—hat every engineer should strive to do his best to secure nder his conditions the maximum possible quantities. To o this is very much a question of supervision and attention o detail. Sometimes (although the best of intentions exist) omething—perhaps incomprehensible for the time, interenes, and obstructs the achieving of the highest results. There is, however, now available very considerable expeence; and by the aid of this and perseverance and keeness, the obstacles to the greatest production can frequently e overcome, and the desired end of doing the utmost possible e realized. A case in point is Newport (Mon.). No one could accuse the ruling executive official there of being anything ut patriotic to a fault, and anxious to express his patriotism n deeds according to his opportunities. There, in the initial tages, the recovery was not in point of volume to his satisaction. Difficulties were met with. But they have now ll been surmounted; and the result is a very substantial uantity of toluol. This is the spirit that is required to-day —a discontent, unless the very best is being done for the ountry in producing the largest possible quantities of the ssentials.

At some gas-works, results that, it must be admitted, are very exceptional, are being achieved; and while it would be impossible for all to rival these results, taking into account coal and plant and carbonizing conditions, it should be regarded by all gas engineers as their bounden duty to attain as closely as possible to the best standards set by working results under circumstances similar to their own. One of the highest achievements has been at the Valley Road Gas-Works of the Bradford Corporation. In this instance, a short time ago no less than 7 gallons of toluol per ton of tar were found in one of the consignments to the tar distillers. It is probable that in this case a rich coal was being carbonized; and it would, of course, be impossible for other works—though the best will and the greatest anxiety prevailed—using coal of lower quality to reach such a standard of working as this Bradford result provides. It must be taken as quite exceptional. Speaking generally, the Metropolitan Gas Companies are keenly at work; and, from among Suburban concerns, the South Suburban, the Wandsworth, and the North Middlesex Companies may be mentioned as instances of undertakings that are obtaining good results. From farther afield, as examples of gas-works undertakings whose results are excellent may be given the Liverpool Gas Company, Brighton Gas Company, Rochdale Corporation, Southport Corporation, Leicester Corporation, Wellingborough Gas Company, Dartford Gas Company, and the Denton Urban District Council. From among the smaller works, the Petworth (Sussex) Gas Company may be specially cited as having done remarkably well in this particular line.

From the Scotch works that have adopted the "C" process uniformly good results have been obtained—so much so is this true that it is almost invidious to specially mention any. But examples—and let it be understood they are examples only—are the Airdrie Gas Company, Bailliston Gas Company, Carluke Gas Company, Coatbridge Gas Company, Cowdenbeath Gas Company, Dalkeith Gas Company, Denny Corporation, Dumfries Corporation, Dundee Corporation, Falkirk Corporation, Glasgow Corporation (they should have special mention), Grangemouth Corporation, Haddington Gas Company, Hawick Gas Company, Motherwell Corporation, North Berwick Corporation, Paisley Corporation, Peebles Corporation, Rothesay Corporation, and Selkirk Gas Company. In regard to Ireland, Belfast deserves special mention.

The works quoted in the two preceding paragraphs are representative of some of those providing the finest results. At the same time, there is not the slightest doubt that, taking the gas-works the country through, more could be done; and till that "more" is accomplished, there will not be the feeling that the gas industry is accomplishing all that is within its power. In this connection, a word to the smaller gas-works. There has been a feeling in some quarters that certain works are too small to work the process. This is a great mistake; and it is very desirable that the smallest of works should feel that it is incumbent upon them to work the "C" process with as much energy as the largest works. This is a case where every little helps. And the aggregate result that could be obtained from the outstanding small gas-works would be most valuable. While so remarking, it must be said, speaking generally of gas undertakings, that the number is comparatively small that have failed to come into line in working the process, and that have not fully realized their individual importance in operating to increase the supply of the essentials for the making of high explosives.

However, let us now all be up and doing in this matter to the full extent of our power. Everyone must realize the vast interests at stake to us as a nation, as well as how much now depends upon the supply of explosives. So realizing, let there be resolve—resolve followed by persistent action—that nothing within reason or possibility shall be left undone to secure what our Army and our Navy require to bring the country the fullest measure of victory.

Fuel Economy—Appointment of a Committee.

We felt convinced when Professor W. A. Bone, F.R.S., of the Imperial College of Science and Technology, read his paper before the British Association recently, and proved the prevalence of a great waste of fuel in the country and of valuable constituents of the raw coal, that he had taken up a question which, if systematically and seriously pursued, would, in the result, prove to be of considerable economic importance nationally. Without thorough system and seriousness, without diligence and personal sacrifice, little could possibly be done in effecting good in a matter which is so extensive that it has no bounds other than those provided by the actual utilization of fuel in many modes and for innumerable purposes. When we come to think of the subject in this way—that is, in respect of magnitude—there are seen complexity and difficulties in the road to reformation of such an immense and varied character as would deter most men from attacking them, although the attack has for its objective national as well as industrial benefit. But the greater the task, and the greater the value emanating from its performance, the greater the honour attaching to those who have part in it. All are to-day trying to sink individuality and to think and act nationally; and it was obviously in this spirit that Professor Bone put forward the case urging consideration of the lamentable waste of fuel that is now proceeding, and of the means of realizing advantage by its suppression. It was also obviously in that spirit that he asked the British Association for the appointment of a Committee to take the whole subject into consideration. We are glad to see from an announcement in another column that he did not make his appeal in vain, and that a Committee has been appointed.

Shortly stated, the Committee has been appointed to consider broadly the subject of fuel economy from a national standpoint, and the lines on which public opinion and action in the direction of a systematic control of fuel consumption can best be organized and directed. There is great scope in the reference; and such scope requires that the Committee shall be representative not only of work but of territory. Much will therefore depend upon the constitution of the Committee; and it will be seen that, in the first instance, the gentlemen invited to join the Committee are scientists and technologists who are, through office and work, closely associated with the promotion of the application of science to diverse industries. At present, the nominated Committee consists of fourteen members, representing the powerful industrial areas of London, Manchester, Birmingham, Leeds, Sheffield, Middlesbrough, Cleveland District, and Glasgow. The names of the members are mostly well known to the professional men of the gas and coke-oven industries. Professor Bone is to be the Chairman of the Committee; and, in addition to him, Professors John W. Cobb (Leeds University), Thomas Gray (Royal Technical College, Glasgow), and L. T. O'Shea (Sheffield University) represent departments of applied chemistry, specializing in the direction of coal gas, coke-oven, and fuel industries generally. Professors J. B. Cohen, F.R.S. (Leeds University), and Mr. E. D. Simon, of Manchester, are both workers on the subject of atmospheric pollution by smoke. Professors P. P. Bedson (Armstrong College, Newcastle-on-Tyne), Harold B. Dixon, F.R.S. (Manchester University), and W. P. Wynne, F.R.S. (Sheffield University), are all eminent scientists. Professor H. S. Hele-Shaw (of London) represents engineering; while Mr. Ernest Bury and Dr. J. E. Stead, F.R.S., represent metallurgy. Professor Richard Threlfall, F.R.S. (Birmingham), and Dr. G. T. Beilby, F.R.S., are both of them very eminent chemical technologists and engineers.

It is a strong constitution. But the Committee has power to add to its number; and, after a preliminary discussion of the lines of work, it is probable some representatives of specific industries will be co-opted—such as mining, coal gas, pottery, iron, and steel. It is also possible that the Committee may be divided into Sub-Committees for the special consideration of particular phases and aspects of the subject, co-opting for this purpose gentlemen with special experience. This, we believe, may be the reason why, in the first instance, representatives of special industries were not nominated. What was desired was to get each of the principal industrial areas represented by some well-known chemist and technologist, who from his position can take a broad and disinterested view of the subject, and can advise as to the best men of the district practically associated with industry whose services in the deliberations of the Committee or Sub-Committee would be of value.

There is a large work here fraught with great economic advantage; and we wish the Committee may in that work realize the fullest success.

The Industry's Work at the Leeds University.

The annual report of the Livesey Professor [reproduced in other columns] is scored all over by the effects of the war; but Professor John W. Cobb is not the man to allow an adverse circumstance to even temporarily completely annul the value of the department under his charge. He bows to the inevitable, but does his best to lighten the situation. Students from the coal gas and fuel industries desire to serve their country directly at the front, or, if they are unable to get to the front, they feel they cannot afford the time for study while the country, in the time of great crisis, can be more immediately served by their work in other spheres. They have therefore temporarily taken flight. Even Mr. H. Hollings has been permitted to suspend the Exhibition Scholarship, and enter the laboratories of the South Metropolitan Gas Company, and to employ his time on war work. But there will be at the end of the war compensations for the present dearth of students.

We are then going to live a new life industrially—at least, so we all hope, and are led to believe. In the gas and coke-oven industries, as well as in other manufacturing quarters, there will be scope for many more scientifically and chemically trained men who can give technical supervision, of which there is a confessed lack to-day. The services of such men are wanted in the gas industry to a larger extent than they are engaged at present, and more than ever on account of the development of plant and processes. In this development and in the economies to be derived from chemical control, there is plenty to be done within the works; and outside trained brains are required to get into touch with work in other industries, in order to help to base the applications of gas in those industries on the surest and most useful foundations. The Sulphate of Ammonia Association and the London Coke Sales Committee have recognized the value of the technical expert in developing commercial work among those who are not in closer touch with the gas industry than as customers or possible customers for those products. Economical working should follow the advent of the scientifically trained man (whose training has been specialized); and the highest level of economy should be maintained by his supervision. We have had some actual practical illustration of this, and have been satisfied that there is profit, represented by hard cash, in an undertaking's investment in chemically trained assistance. The same thing was illustrated at the British Association meeting in connection with the coke-oven industry. The South Wales coke-oven plants have also been locally arraigned as the sources of much waste, owing to the absence of chemical supervision. However, the various industries whose processes present openings for chemical control must be worked up to full appreciation of these things. The war is helping in this direction. Given the demand, the Universities and Technical Colleges—the Leeds University among them—specially devoted to scientific training for industrial operations will have a busy time in preparing a constant stream of men for a larger and more useful life in the actual productive work of the world. The temporary break in activity occasioned by the war is, we hope, only the lull before the storm for the Universities and Technical Colleges.

But though Professor Cobb is having a comparatively lonely existence just now, through the loyalty to country of those who would otherwise be studying under his direction and assisting in the research work of the department, he is by no means idle, helped by the few remaining to him. His report shows that between them they are keeping afloat the investigations that were previously taken in hand on behalf of, and in consultation with, the gas industry. Outside the laboratories and lecture rooms, Professor Cobb and his assistants are also carrying on good work for the gas industry, by bringing certain of its problems before the chemical societies. For years the gas industry lived within itself, and did not pass beyond its own borders. Except the limited number in actual service in the gas industry, few chemists knew little, if anything, about the work and products of the gas industry, about the fascinating problems surrounding them, and about the processes that yield products which are basic in other industries. As to the primary product of the industry, outside chemists had the most crude notions as to its applications and effects—as crude, in fact, as the layman, or the electricity salesman, without an atom of chemical knowledge. The last few years have seen a change coming over this condition of things. Many papers on matters affecting the technical interests of the gas industry have been read before chemical and other scientific societies. In this, Professor Cobb has lately been taking part. It is all to the good. The more the industry and its work are known by influential bodies, the better. All possible help is wanted by the gas industry from those who can be of service to it in other industries; all means of removing fallacy is desirable. We are on the right road in this matter; and by the assistance of the Livesey Professor and others who have close association with the gas and fuel industries, and can act as connections between professional gas organizations and other scientific and technical bodies, there will be valuable development.

Heat Treatment of Iron and Steel by Gas.

There is considerable practical value in the research work that Professor A. H. White is carrying on, in collaboration with his assistants and students, in the Chemical Engineer-ng Department of the Michigan University. We have further examples of this in two papers which Professor White and Mr. Homer T. Hood have presented to the Michigan Association. One is on gas as a case-hardenng agent, and the other deals with the heat treatment of iron and steel in a neutral atmosphere; and the materials for these papers are provided exclusively by investigation. The paper on the second subject is reproduced in our columns to-day; and it has a significance and value which, n our view, exceed the actual results achieved by the reasonng, invention, and experiment as set forth in it. It will be seen that the paper carries us beyond the usual lines of research work in relation to the industrial applications of gas; and we think it, as well as the companion paper, will be an ncentive to others to prosecute work in new directions with the view of enhancing the efficiency of gas in manufacturing operations. Up to now, investigation in the matter of the application of gas to industrial heating has been largely imited to the improvement structurally of burners, furnaces, muffles, &c., with the view of realizing the largest heating efficiency from the gas consumed. On behalf of the utilization of gas in industrial heating, claims, too, have been based argely on availability, time economy, heating efficiency, temperature uniformity, means of temperature regulation to requirement, and improved quality of product as a result of this uniformity and capacity for regulation. All this is good, but it is not enough; and the question which, we imagine, must have preceded Professor White's and Mr. Hood's joint researches into the heat treatment of iron and steel was, Can the gas system of heating furnaces and muffles be so manipulated as to secure for the manufacturers of iron and steel goods further advantages than those proceeding from the conditions already mentioned? There is the loss of metal due to the decarburization and then oxidation of the surfaces of iron and steel due to heating to high temperatures in furnaces where the metal comes into contact with flames, smoke, gas, or other oxidizing atmosphere. Not only is the resulting loss of metal of considerable importance, but the question of decarburization has become of greater consequence owing to the demand for higher standard quality steel. There are, of course, known ways and means of overcoming the decarburization. But they cannot be said to be successful in respect of thermal efficiency, and there are considerable difficulties in securing the necessary conditions.

Professor White and Mr. Hood started on their investigation with an assumption that was drawn from known effects. Heating in illuminating gas alone causes carburization of steel; heating in the ordinary products of combustion causes oxidation. Therefore the deduction that something between these two extremes should be a composition practically neutral in its effect upon steel, and the conclusion that it should be possible to construct a muffle furnace with semi-direct firing, in which a mixture of coal gas with a small amount of air should burn to form a neutral atmosphere, and subsequently burn with more air round the muffle, and so, in this way, largely utilize the thermal value of the gas. The paper introduces us to considerations, the results of step-by-step experiments, and a description of the laboratory furnace devised for securing the conditions of a high temperature, and yet burning a rich mixture of gas and air. In considering the thermal efficiency results, it should, of course, be borne in mind that it should be possible with a larger furnace to get a higher thermal efficiency than with the small laboratory furnace employed, though expectation has always to be qualified by the knowledge of the frequent disappointment experienced in transferring work from the laboratory to the working scale. The coal gas experimented with had a heating value of rather more than 600 B.Th.U.; and, on combining approximately 1 volume of this gas with 2 volumes of air (preheating the mixture), a neutral atmosphere was produced. Although neutral to iron, steel was decarburized slowly at forging temperatures, but nothing like what occurs with the ordinary furnace atmosphere. Such activity as there is may be rendered less by using a mixture still richer in gas. "At the lower temperatures used "in heat treatment, gas of this composition would cease to "exert a decarburizing action." Means are discussed by which the thermal efficiency may be increased.

Subject to the impossibility of speaking too definitely from laboratory experiments, the process appears commercially applicable. The cost of fuel would very probably be higher than under existing methods; but compensation should be more than provided by a considerable saving in metal. Further, if in iron and steel manufacture, decarburization and oxidation can be avoided, this condition would be the precursor of other manufacturing economies. Work of the character that is being carried on at Michigan University should help considerably in establishing town gas still more effectively in iron and steel manufacturing operations.

Artificial Lighting and Deficient Public Knowledge.

When one prominent gas engineer begins to talk in public of doing what is tantamount to handing over in its entirety the lighting business of the gas industry to the electrical industry —although he does not think this likely to occur earlier than a period remote from the present—and setting the gas industry to develop the immense area open for the application of gas to domestic and industrial heating, it is the duty of the remainder of the men of the industry to inquire the wherefore of this manifest lapse in faith, though that prominent gas engineer may stand alone in his view, and may have been totally mistaken in the premises from which he has made his deductions. So far as we gather, the engineer in question has been persuaded to the view he has published from the "housetop" provided by the British Association because he has detected a preference among a certain section of the public for electric lighting, and his opinion is that there would be a larger transfer of lighting custom were it not for the expense of electrical installation. Perhaps there would be; but there would still be a large majority of the public who would use gas, and whose custom is not by any means a negligible quantity. What is there that electric lighting has that gas has not got? The electric light has convenience in switching-on and switching-off; gas has like convenience, but the pilot light is in comparison a disadvantage. Electric-lamps, too, lend themselves to certain decorative effects which gas cannot emulate. But it cannot be admitted that there is any more beauty in electrical fittings than in those for gas lighting. Gas-fittings are procurable in styles as choice as anything that electric light can present; and with the inverted gas-burner, the most exquisite glassware can be used—just as with the electric lamp. The beautiful examples of fittings and glassware seen at the National Gas Exhibition, those at the splendid display made by the South Metropolitan Gas Company at the Ideal Home Exhibition, and those to be seen in every gas show-room that is worthy the name, are testimony to this being so. Then there is the quality of the light. The incandescent gas-light has a much lower intrinsic brilliancy than electric lamps; and the modern forms of the latter multiply this harmful defect many fold. The composition of light and diffusive power are also to the advantage of gas. Quality is something that is important the whole time that artificial light is required; and so is economy. The convenience of being able to light-up and to extinguish lamps without keeping a pilot jet in use is something that is far less important in point of utility than the qualitative properties that are in favour of gas.

When this is the position, and when, despite it, a prominent gas engineer—although alone in his views—gives it as his settled opinion that sooner or later, whether we will or not, the lighting business will slip from the grasp of the gas industry through a preference on the part of the public, it shows conclusively, if true, that that gas engineer and the gas industry generally are not doing all that should be done to educate the public regarding the scientific aspects of the rival systems of lighting. On more than one occasion, Mr. Jacques Abady has expressed surprise that the gas industry, instead of always talking as though on the defensive in connection with this lighting question, does not take the offensive, in view of the strong support of the qualitative and hygienic attributes of gas lighting. But the gas industry moves along in a curious fashion in this particular matter. It appears, in its propaganda, to consistently follow the lines of least resistance. In domestic and other heating, in water-heating, in cooking, in industrial heating applications, it is in an enviable position—a position that cannot be wrested from it by the electrical competitor. Yet these are the lines that are most assiduously advertised with a view to business development. But business maintenance is equally important; for every consumer lost means that not only has the extent of his business to be recovered elsewhere, but something beyond before it can be said that the business of the undertaking as a whole has developed. And the business that requires most attention, in order to maintain it, is that of lighting—the reason for this being the deplorable ignorance on the part of the public as to the scientific considerations that underlie the subject, which is one of real importance to every individual. It should be the business of the gas industry to see that the public are tutored in these matters—properly and effectively. And, coincidently, it would be well if, in this connection, certain words were borne in mind that were used last week by the Earl of Derby regarding another matter: "No man has "the right to say that any system is a failure unless he has "done *his* best to make it a success."

Mention has been made of the hygienic aspects, in which quality has part. Some time ago an investigation into these aspects was made by Professor von Gruber; and the results were incorporated in a lecture to the German Association of Gas and Water Engineers. These results, as Mr. W. J. A. Butterfield, M.A., F.I.C., has pointed out, in a critical examination of them in our columns [see "JOURNAL" for Sept. 14 and 21], are of a misleading character, and may do untold mischief to the gas industry unless countered. Mr. Butterfield pilloried the learned but egregiously careless von Gruber. He showed how loose and defective were his methods of investigation, and consequently how unacceptable and unworthy of credence the results. Of these use may be made by unscrupulous rivals among the general public, who have no means of examining them aided by the comments thereon of a competent critic. This being so, Mr. Butterfield suggested, at the end of his criticism, that research should be carried out in this country, under properly devised conditions, into this highly important lighting question; and that the results should be translated from the terminology and locution of the laboratory to language that would be understandable by the people, and be distributed broadcast among them. We have at the present time a Ventilation Committee, representing the Institution of Gas Engineers and the Leeds University, through which research into ventilation problems is being conducted. The work of the Committee does not go so far as Mr. Butterfield desires. He counsels chemical and physical investigation of lighting questions under conditions that are ordinary, and not extraordinary through the use of a box-like structure within which research is pursued, and in which ingress and egress of air are regulated, in which there are air-tight window and entrance, and the walls and ceiling of which have nothing in common with the walls and the ceiling of an ordinary room. An investigation on the lines generally defined by Mr. Butterfield is badly wanted. Professor Vivian B. Lewes, Dr. Samuel Rideal, Mr. Otto Hehner, Dr. Leonard Hill, Mr. Butterfield, and many others, have done excellent work, which has contributed largely to our knowledge of the subject. But this work wants co-ordinating by a systematic, detailed investigation under ordinary representative conditions of domestic use, and the results presented in a manner which all would understand.

It was not long ago that Mr. Charles Carpenter, D.Sc., said that lighting is still the backbone of the business of the gas industry; and, this being so, nothing ought to be left undone—from the quality and constancy of gas to the assurance of high efficiency at the burner—to advance and protect the business. Advancement and protection can only be accomplished by going to work the right way—by method, thoroughness, energy, and a full intent to spread complete knowledge among the public on the hygienic and qualitative questions affecting the two illuminants. There is confidence that the gas industry has a good case; then let this confidence be backed up by action, to the end of the preservation of the lighting business.

Tankless Gasholders.

SINCE Mr. William Gadd's spiral-guides relieved gasholders of the necessity of having any external guide-framing, there have been no revolutionary proposals, until lately, for the modification of gasholder construction. The divesting of holders of the outside guide-framing was a big step from conventional methods; but a still larger one would be achieved if there could be deliverance from the holder water-tanks. The most expensive and generally the most critical part of a holder is the tank; and the attendant costs and risks vary with the character of the subsoil and foundation in and upon which the tank is constructed. If tanks could be discarded, then there would be a considerable lightening both of the costs and the risks of holder construction.

An attempt has been made at doing away with the tanks. At various times, our "Register of Patents" in the last volume [commencing with the "JOURNAL" dated Aug. 3] showed this; and the proposal has attracted the attention of technical men both in this country and in America. The invention is a German one; the patentees being the Maschinenfabrik Augsburg-Nürnberg. Quite briefly stated, the holder is simply a plain cylinder, constructed to any size required, without water-tank and guide-framing, or being divided into lifts. Anything that is gas-tight would do for the storage of gas, if that were the only function of the holder. The holder, however, has to give the necessary pressure to provide an adequate supply of gas throughout a district; and this is the principal difficulty in utilizing a rigid structure for storage purposes. In the Nürnberg invention, the cylindrical holder has an inner disc-shaped crown which travels up and down; and round this is a channel for a liquid seal, the depth of which can be regulated to provide the weight for throwing the requisite pressure. The crown is guided by a central column, running on guide-rollers, through the trussing of the roof. The principal difficulty—two patent specifications subsequent to the first one indicate this—is to maintain a tight joint between the water-seal on the disc-shaped dome and the side of the holder. One method, which is described as successful, has been to fit round the sealing part packing strips, and solid material of wedge-shape section, which form sliding pieces. It is clear that the packing must be flexible, so as to follow any deviation in the shape of the wall of the holder, in order to reduce to a minimum the clearance space even when the holder is in action. The escape of water from the seal, under the improved method of packing, is said to be very trifling; and, such as it is, it is caught in an annular channel in the floor of the holder, whence it is pumped back to the feed-tank from which the seal in the moving crown receives compensation. From this it will be seen that there is practically no loss of liquid. Ordinary gas tar, it is stated, has been found suitable for the seal; and it has the advantage that it is quite unnecessary to warm it to prevent freezing in the winter.

The principal doubt rests at the point between the cylindrical shell and the periphery of the travelling dome. We should like to have a good running experience to ascertain that trouble was not going to occur there through leakage of gas to the space above the dome, and undue leakage of water to below it. There is also the question of the effect upon pressure of friction, in the event of even comparatively small deviations from the truth of the cylindrical holder impeding the working of the inner dome. Complaint is made by some hypersensitive persons of the disfigurement of landscapes by present-day telescopic gasholders; and these large cylindrical structures, which would never wholly or partially recede into their tanks as do the telescopic ones, would be a greater eyesore still. But this is only a sentimental disadvantage which must not be allowed to stand in the way of practical utility if the new type of holder justifies itself.

There are obvious advantages in the new invention, if proved trustworthy in working. It appears that there has only been in operation one experimental holder of the new type, and this has been at the Gustavburg works. But one f 45,000 cubic feet capacity is in course of erection at the ugsburg works—the contract price being the same as that or a holder of the ordinary type of only half the capacity. t is manifest that—with the tank, standards, bracing, and uiding arrangements removed, with all the structural work onnected with the telescoping of holders dispensed with, nd with the load on the foundations comparatively trifling -the capital cost of such a holder should be relatively low. he holder itself, too, would not be exposed, as are the lifts f an ordinary holder, to the deterioration caused by the nmersion of the lifts in the tank water. The cost of up- eep and depreciation should be considerably less than in e case of an ordinary holder; and interest on the capital er unit of capacity would be relatively low. It is plain at in the new type of holder there are numerous advan- ges. The question is whether reliance can be placed the structure performing those functions which are in- ispensable in addition to storage with the regularity that essential, and which is obtained with holders of ordinary onstruction. If so, then there will be something for which thank the Augsburg-Nürnburg Engineering Works; for conomy in structure and working parts is as desirable in asholders as in other structures, providing there is no loss efficiency.

al and Coke Exports.

The Board of Trade returns relating to the shipments of coal d other fuel show that whereas in September, 1913, 6,197,180 ns of coal were exported, in the past month 3,892,033 tons left r shores—being a reduction of 2,305,147 tons. In September st year (the second month of war), 3,859,188 tons were exported; that upon this figure the exports of last month exhibit an ad- nce of 32,845 tons. The reduction of coal exports during the st year of the war (ending in July) amounted to 29,566,410 tons. mpared with the corresponding periods of 1913, August and ptember respectively presented reductions of 2,168,690 tons d 2,305,147 tons, or together 4,473,837 tons. In the same two onths of last year (when shipping business was considerably set owing to the declaration of war) the reductions on 1913 were spectively 2,748,420 tons and 2,337,992 tons—together 5,086,412 ns; so that in August and September this year we have ex- rted 612,575 tons more than in those months of last year, ough still 4,473,837 tons less than in the same two months of 13. There is no cause to complain of this increase in exports en we consider that in August France took nearly 1 million ns more than in August last year, and that these are the quan- es of her purchases from us in the month of September the t three years: 1,040,489 tons in 1913; 569,667 tons in 1914; 87,755 tons in 1915. Bearing on the recent complaints from rthern gas undertakings regarding what is considered to be unnecessary control that is being exercised over gas coke ex- rts, we showed in the "Journal" for Sept. 21 there was an im- ovement in August in the quantity of business done abroad ntrasted with the corresponding period of last year. The coke ports for August, 1913, amounted to 113,423 tons; 1914, to 68,498 ns; and 1915, to 89,574 tons. While September of this year ibits a considerable improvement on August, the month, com- ed with last year, is considerably in arrear. The coke exports September, 1913, reached 125,357 tons; for September, 1914, ,264 tons; for September, 1915, 108,471 tons.

al Exports to Holland.

References have previously been made to this subject, cause the gas industry as a large coal consumer is interested two ways. It is first to its interest that sufficient coal shall be ot at home to adequately supply this country; and, secondly, it to its interest that the enemy countries shall not be benefited, her by obtaining the excellent quality coal of this country, or securing for German coal the entire coal trade of neighbour- countries to which they have access. The British gas in- stry is therefore patriotically and immediately concerned. The ormation on the subject as given in our columns has been ained from the "Iron and Coal Trades Review;" and it has own that the coal trade of Holland is under the supervision of Kohlenbureau, which is dominated by the Westphalian Coal ndicate. This is a very undesirable position for more than reason; and our contemporary appeals to all and sundry erested in the matter to help to bring pressure to bear upon our Government to move in the matter of endeavouring to end the control in Holland of the German Syndicate, which is a detriment to this country. "It is surely," writes our contemporary, "to the interest of everyone in this country, apart from coal exporters and collieries, to see that the Dutch trade is not controlled by the German Syndicate in the way it unquestionably is at the present." Our contemporary supplies information, the validity of which cannot be questioned, that firms in the Netherlands who do business with British collieries, and who refuse to join the Kohlenbureau, are being squeezed out of business. The Kohlenbureau insist that all the details of transactions by firms engaged in Holland in the British coal trade shall be placed in their hands, and thus in the hands of the Westphalian Coal Syndicate. The only object of this can be to cut British coal out of Holland as far as possible, and so create a larger export trade for the Westphalian Coal Syndicate. There is another side to this matter. A correspondent of our contemporary, writing under the *nom de plume* "Shipper," says that shipments are being made to firms in Holland which, although nominally Dutch, are in reality German firms, and in one case at least is under the direct control of the Westphalian Coal Syndicate. In this connection, there is interest in the exports to the Netherlands for September in the past three years: In September, 1913, 154,904 tons were exported to Holland; in September, 1914, 276,031 tons; and in September this year, 174,996 tons. The figure for September, 1914, is especially suspicious. All the evidence supplied by our contemporary indicates that there is an ample case on which our Government could intervene. One thing is certain, that the British coal trade with Holland is at present governed by Germany.

Future Possibilities.

It is a very proper thing to take stock of current conditions, and, by the aid of what is learned from so doing, to consider future possibilities. Many countries will be doing this, in view of their inability to obtain certain things for which they have been accustomed to rely upon Germany and Austria. We are sorry that events compel the incommoding of those countries. But perhaps in the end it will be to their good. The war means that henceforth there is going to be a greater devolution of work, through the necessities of countries. They have been critically examining themselves to see whether they have been making the best use of their own opportunities, and of their capacities for being independent, and are finding out that in several respects there is no reason whatever why certain things made (say) in Germany and Austria need travel to them over sea, inasmuch as they can quite well produce them at home. A Canadian bulletin, on "The Products and Bye-Products of Coal" (from which some interesting extracts are given in this issue of the "Journal"), shows that Canada has been indulging in a little introspection in this regard. Like many other countries, Canada has been importing dyes from Germany; but the volume of their requirements is not thought sufficiently large to encourage the founding of a flourishing dye industry in the Dominion. But in this country, though dyes to the value of millions sterling were imported from Germany, certain firms have done an excellent business in home-produced varieties, with an annual value of not more than (say) three-quarters of a million. It paid them; it is paying this country now to expand its producing capacity. Why should not Canada make a start, or is the business smaller than warrants even a beginning? We have no data on the subject to guide to an opinion. However, dyes are not the only things produced from tar. There are other products of great commercial value; and the bulletin points out that they are peculiarly suitable for production in Canada. Taking up this work would render the Dominion independent of foreign sources of supply. "Necessity" is not only the "mother of invention," but of commercial enterprise. So we may expect to see various overseas countries internally developing industrially by supplies from Germany and Austria being cut off. If this happens, those countries will have gained some benefit from the war.

Society of British Gas Industries.—The autumn general meeting of the Society will take place at the Trocadero Restaurant on Thursday, Nov. 4, when a short report on the work of the Society during the past six months will be given by the Chairman of the Council (Alderman F. Templer Depree, J.P., of Exeter). This will be followed by a discussion. Afterwards there will be afternoon tea, by invitation of the Chairman of the Council. In consequence of the war, the usual dinner will be dispensed with.

BRITISH ASSOCIATION COMMITTEE ON FUEL ECONOMY.

As an outcome of the recent Manchester meeting, the British Association have invited a number of gentlemen to serve on a Committee to consider and report upon the question of Fuel Economy (Utilization of Coal and Smoke Prevention). The function of the Committee is to consider the whole question of fuel economy and the better utilization of coal from a broad and national standpoint, in order to urge upon the Government and the community generally at this juncture the need of systematic scientific control of fuel consumption on public lines as a direction in which large national economies can be most healthfully and advantageously realized in the immediate future. This matter has already been the subject of discussion in our Editorial columns, and further reference is made to it to-day.

It will be seen from the following names of gentlemen who have been invited to serve that the Committee [which is empowered to add, if necessary, to its members] has been selected so as to include representative chemists, engineers, and technologists from all the principal industrial areas.

Professor William A. Bone, F.R.S., Imperial College of Science and Technology, London (*Chairman*).
Mr. E. D. Simon, Chairman of the Manchester Air Pollution Committee (*Secretary*).
Professor P. P. Bedson, Armstrong College, Newcastle-on-Tyne).
Professors J. W. Cobb and J. B. Cohen, F.R.S., Leeds University.
Professor H. B. Dixon, F.R.S., Manchester University.
Professer Thomas Gray, Royal Technical College, Glasgow.
Professor H. S. Hele-Shaw, F.R.S., London.
Professors L. T. O'Shea and W. P. Wynne, F.R.S., Sheffield University.
Professor Richard Threlfall, F.R.S., Birmingham.
Dr. G. T. Beilby, F.R.S., Glasgow.
Mr. Ernest Bury and Dr. J. E. Stead, F.R.S., Middlesbrough and the Cleveland District.

PERSONAL.

Mr. Albert North, foreman at the Ossett Corporation Gas-Works, has been appointed Manager of the Rugeley (Staffordshire) Gas-Works. His new charge supplies a population of about 6000 people and provides for a consumption of some 20 million cubic feet of gas per year.

Corporal John Holliday (formerly Gas Engineer at Scarborough, and later at Hull), who joined the Royal Engineers in February as a sapper, and after four months' training at Buxton with the 141st Fortress Company was transferred to the Chemical Section, is, to use his own words, "knocked out for the time being;" and we trust it will only be a short time. He is back from France, and in the American War Hospital at Paignton.

The issue of "Het Gas" for the 1st inst. reports that on Sept. 1 Heer J. H. Franken celebrated the completion of forty years' association with the gas industry—he having entered the service of the Corporation gas undertaking of The Hague on Sept. 1, 1875. During 1883, he became Assistant-Engineer at the Amsterdam works of the Imperial Continental Gas Association; and when the works were taken over by the Municipality in 1898, he was transferred to the staff of the Association's Antwerp works, to which he is still attached.

Sergeant Charles Valon, of the Leicestershire Yeomanry, who was wounded last February in a manner which resulted in temporary paralysis of the arms and legs, is, we are glad to hear, making some progress towards recovery, though it is only very slow. He has to some extent recovered the use of his limbs, and, what is perhaps even better, is now convinced that he is going to make a complete recovery. When the war broke out, he had resigned a position under Mr. Hubert Pooley at Leicester, to take up an appointment at the Bath Gas-Works. Mr. Jack Valon, who was engaged at the Singapore Municipal Gas-Works, has been given a Commission in the Royal Sussex Regiment. He is not yet in France, but may be going at any moment.

OBITUARY.

The death has taken place at Saltburn of Mr. William I'Anson, Assoc.M.Inst.C.E., who for nearly fifty years occupied the position of Secretary and Engineer of the Cleveland Water Company. The deceased was 68 years old, and was a native of Richmond.

In "Het Gas" for the 1st inst. there was a report of the death on Sept. 22 of Heer C. J. van der Plank, the Manager of the Assen Gas-Works. Deceased was son of the Manager of the Amersfoort Gas-Works, where he had acted as Assistant-Manager for four years—becoming in 1898 the Manager of the Zalt-Bommel Gas-Works, which position he vacated in 1901 to take up the managership at Assen. Heer van der Plank was only 44 years old.

THE INTERNATIONAL GAS CONGRESS AT SAN FRANCISCO.

By Arthur H. Elliott, Ph.D., M.S.

San Francisco, *Sept.* 25, 1915.

It is very difficult to realize how well our California friends have anticipated, and bounteously provided for, the advent of the International Gas Congress, and the meetings of the American Gas Institute and the Pacific Coast Gas Association. The leading spirit is very dominant; and his executive ability and big-heartedness are seen everywhere. Mr. E. C. Jones, the genial Chief Engineer of the Gas Department of the Pacific Gas and Electric Company, is a sterling character; and everything echoes with his cry of "Have a good time in San Francisco." This does not mean mere trifling fun, but earnest purpose and profit, with hearty good nature and a keen eye to progress.

The provisions for service to the visiting officers of the Congress and Institute have been more than generous; the ample offices at the "Hall of the Native Sons" speaks volumes as you arrive to register and get programmes and literature. The kindness and willingness to help visiting brother gas engineers are evident, turn where you will; each appears to emulate his fellows to show *bon camaraderie.*

New York, Chicago, and the East have sent about 120 men, which, considering the distance—2000 to 3000 miles—is a very fine showing of attendance. Even Sunny Honolulu sends delegates to participate in this Congress of men of light and energy. California's sons are here in great numbers, and full of the spirit of welcome; making a total of about 500 men and many ladies. When we consider that this city was a pile of burning ashes only nine years ago, what we see now seems almost beyond belief; while we note that there is scarcely a trace of the devastation left which almost paralyzed its people at that time. Now we see handsome stores, shops, and office buildings; magnificent hotels, second to none in the Eastern States or Europe; handsome residences perched picturesquely along the hillsides. We can only wonder what titans have been working these achievements in steel, stone, and concrete; to the building of a San Francisco that must be a model city for future generations to admire, and to stimulate the hearts to the promotion of the spirit of the Golden West.

San Francisco is a city of about 550,000 people under normal conditions, but now crowded with humanity to the extent of about 800,000. Its handsome wide streets, its thousands of automobiles, its brilliantly lighted avenues and roads, its splendid electric trolley and bus service, all point to a future not now dreamed of; making it another New York on the Pacific Coast. It is already beginning to feel the opening of the Panama Canal; and ships from France and Italy and many other European ports, steaming through the cut in the isthmus, are seen loading and unloading at San Francisco wharves. The balmy and refreshing air of the city, not hot or cold, almost always sunny, gives vigour to men not to be found anywhere else in the United States. There is a tang to the air that must be felt; it cannot be described in words or on paper.

This marvellous exposition, built with an expenditure of fifty millions of dollars, and even now paid for, yet has to Dec. 4 to run, is beyond description on paper. The architect, the painter, and the men of stone and concrete have vied with one another to see who could best fulfil the spirit of California in that galaxy of flowers, form, and sunshine that carries one beyond earth to some paradise pictured, but almost not to be realized. And yet it is here. In daytime the vistas of beauty in travertine-like walls, with columns and pilasters of terra-cotta, rich with details that some artist has breathed his soul into, to give impressions beautiful in form and figure, are most harmonious, and carried to heights of 80 to 100 feet. Walls also are seen, formed of creeping plants, towering 15 or 20 feet, and begemmed with flowers of purple, blue, and red. Against such backgrounds statues in marble, bronze, and terra-cotta, telling stories of life in every phase, from sweet childhood to old age, hold the observer fairly transfixed with their beauty and the joy of harmony.

When night falls, and the shadows give the buildings that hazy hue where twilight calls to rest, we see peeping lights begin to dot the scene, and, light after light appearing, there opens up another revelry of beauty, due to another band of artists—the men of light and illumination. Then, as darkness deepens, the joyous display of light and colour transforms the buildings, towers, and spires into a fantastic beauty that must be seen—no pen can describe it. It is very doubtful whether anything like this can be surpassed. It is due to the genius and broad ideas of Mr. W. D'A. Ryan, the illuminating engineer whose brain conceived and carried out these colossal effects. By a combination of gas and electrical illumination never before attempted, and where each supports and amplifies the other, he has produced at night a scene so beautiful that it is hard to choose between it and the beauties of daylight and sunshine.

This is the environment of those who see San Francisco now. Its men and women are as bright as the scenes they have created. If the world would only forget war, and come to California, Mars would be banished for ever, and "Peace on Earth Good Will to Men" the only motto on a banner leading all nations. The picture attempted above is of men and things that are virile with California life, and some of the moving spirits should now be noted.

Since we are here to take notice of the development of gas, we must not forget the man who has transformed gas manufacture n California, and perhaps the world over—Edward C. Jones. Harking back some thirty or more years ago, we see a band of men with William H. Bradley, the veteran Chief Engineer of the New York Gas-Works, struggling with water gas, and pulling out of a tangle of methods the process of Tessié du Motay, the irst practical means to serve any large city with water gas lightng. This story has been told many times; and its chief engineer has lived to see yet another epoch dawn like the one to which he then pointed the way—*i.e.*, the development of oil gas n California.

It must be remembered that a little spark from Bradley's torch dropped on E. C. Jones, of San Francisco, about thirty-five years ago, when he visited the veteran chief in the works at New York. This spark continued to hold out to burn until the moment when, n the Golden West, Edward C. Jones faced the problem of making gas with expensive coal and cheap oil. Now, after many years of toil, he has evolved a method using oil only and steam, where, in a set of generators, of about 18 feet in diameter and 5 and 65 feet high, he can produce daily an output of 12 million cubic feet of finished gas. Not a pound of coal is used to do the work. The oil has a density of 19° Bé., and the gas a calorific value of about 650 B.Th.U.

Nothing in words can describe this new achievement in gas manufacture. A generator house free from coal and its incidental dust and dirt, clean almost as a modern, well-kept engine room, with a working floor and neat tables for records of runs and data of manufacturing as tidy as an office, is certainly novel as seen in he manufacture of oil-water gas. No one can conceive a gas-works so clean until he sees this outfit. There is nothing to make t dirty.

Next Monday the sessions of the Pacific Coast Gas Association and the American Gas Institute, as well as those of the International Gas Congress, begin. Everybody seems ready to take an active part in them; and there are a goodly number of papers on echnical as well as commercial subjects.

No trouble has been spared by the men in charge to make everything run smoothly, and success is assured; the success now being enjoyed and expected by the men of California.

ELECTRICITY SUPPLY MEMORANDA.

A Friend in Need.

IT is so rare that the electrical people get hold of a man in the front position in the gas profession to say anything they can put to practical use in developing their own business, that they find it difficult to drop Mr. J. G. Newbigging's British Association paper, and the solitary attitude he took up regarding the competition for lighting where supplies of gas and electricity are in the possession of a municipal authority. What Mr. Newbigging said in his paper was so absolutely n accord with what our electrical friends wanted, that they were almost beside themselves with joy when he made in the "Correspondence" columns of our issue for Sept. 28, reaffirmation of his views, but adding something which our electrical friends do not approve of, judging by their silence. The ignored point is that Mr. Newbigging infers that his considered opinion is that it is "A ong, long way to Tipperary"—in other words, that what he, as a prophet, has prognosticated will not come to pass until very far n the future. There is personal safety in this attitude, because it gives one plenty of latitude, which may mean anything from a few years until after that time when matters of the kind will not be the subject of meditation, and will not disturb our peace in the least. The "Electrical Times" heads its latest reference to Mr. Newbigging's opinions on this matter with the interrogation, "Is it a Dream?" And it cannot get further than hypothesis, and the support of Mr. Newbigging and Mr. F. D. Marshall [see also our "Correspondence" columns for Sept. 28] in what follows from he pen of "Meteor," so that there is not much to help us there. "Electrical Industries" designates Mr. Newbigging "The Honest Heretic."

Dreams.

The first-named paper finds that our Manchester friend has passed from an attitude of philosophic doubt to one of open commendation of the electric light. And, gleefully, it remarks: "Ten years ago—nay even five years ago—who would have dreamed such a thing would be possible?" As to Mr. Marshall, the paper proceeds to say: "Later on, perhaps, the gas men and the electrical engineers may become the best of riends on the lines indicated by Mr. Marshall. But not until circumstances have inevitably forced the contest for domestic heatng and cooking to a similar decision. That process will not be beneficial for the disputants; but while human nature remains what it is, this destructive competition for the aggrandisement of an indifferent public must be carried to its only logical conclusion." The "perhaps" is indefinite. The "similar decision," and he "only logical conclusion" are indications of a hope which, read in conjunction with the headline "Is it a Dream?" is permeated with much doubt. In fact, "Meteor" does not let his readers see all that is contained in the covert recesses of his mind. If he did, it would most probably be found that the notion of gobbling-up the whole of the business of the gas industry, and then making the professional gas man a sort of engineer-in-charge of the plant producing gas for electric generation, and of that required for the development of the residual products of carbonization, is regarded by him as having as much prospect of realization as that he will some day be the tenant of a castle in the air. Of course, he knows very well, although not permitted to proclaim the fact, that such an idiotic thing will not occur as the supplanting of a cheap heating agent by an extraordinarily expensive one, with the view of promoting further uneconomy in the world. If we were asked to guess what is likely to happen in this connection in the future, we should give reply that gas will be the general fuel, and that the trading in it will be of such huge volume that the lighting business will be nothing more than a pendant of the main business. So many industries and the very security of the country are dependent upon the products of the carbonization of coal, that carbonized it must be. The enlargement of the gas-heating business will develop the cheap supply of the products that these industries and the country require. The development of the gas industry, the processes of which are fundamental ones, should tend to cheapness. Then why should not electricity become a sort of bye-product of the gas industry. There is more sense in suggesting this than in anticipating complete absorption of the gas industry's business by the electricity industry, and the conversion of the gas industry into something merely ancillary to the generation of electricity.

What the World Said, and How it Acted.

"Electrical Industries," on the same subject, opines that in time the "JOURNAL" will realize that "what Mr. Newbigging said yesterday, the world said the day before." We should have been very deaf if we had not heard what the world said the day before Mr. Newbigging spoke. Only if the world had previously decided the respective destinies of gas and electric lighting, why is it so long acting upon its decision? There must be reasons; and the reasons that have been deterrent up to the present are still strong. What the world said and how it acted seem to be in opposition. If our friend is right, then the lighting business of the gas industry ought to have collapsed ere this, whereas we cannot avoid the facts that the business of the gas industry, after daylight hours, is as large to-day—despite the economy of incandescent gas lighting and the competition of electric lighting—as the total business of the industry when electricity first entered the public service; and that since that time the volume of the industry's business has about doubled, giving to the daylight hours a business the equivalent of the total possessed in the early eighties. These are facts that the scribes and prophets—comic and otherwise, mostly the former—of the electricity industry avoid as much as possible. "Electrical Industries" smiles at our contention that the quality of gas light is superior to that of electric light, regarded from the standpoints of intrinsic brilliancy and composition. But there is no categorical denial of our statements; only the usual sloppy electrical plan of getting over ugly, rough places by treating them as though unworthy of serious notice.

A Spectacled Race.

The same day that our contemporary published its superficial remarks on the question of the quality of the two lights, a circular was forwarded to the writer of "Electricity Supply Memoranda" which has been widely distributed by a firm of surgeons' opticians carrying on business in the West-end. This is the opening paragraph of the circular:

> When one complains of the eyes feeling weary and sore, there is little doubt that the cause is generally due to the chemical and heat rays which are given off in great quantities by the present-day electric lights. These rays which are technically known as "ultra-violet" or chemical rays, and "infra-red" or heat rays, have the effect of causing electric ophthalmia. Where electric light is habitually used for reading, it is quite obvious that the harmful rays given off from it and reflected into the eyes from the white paper, must cause a great amount of harm. Experiments on both human and animal's eyes have proved that electric ophthalmia *is entirely due to the ultra-violet rays emitted from electric light.* More important still, it has been shown that electric ophthalmia is often but a stepping-stone to cataract. Therefore, the need to counteract the harmful rays by the most practicable and least uncomfortable means is of vital necessity.

Then the circular goes on to allude to the experiments made by Sir William Crookes, which resulted in the production of a new ophthalmic glass, which "resists all the harmful ultra-violet and infra-red rays." Again: "Eventually two kinds of glass were developed . . . suitable for ophthalmic use, and both of which combined in the highest degree the ability to cut out both the heat and the chemical rays without at all interfering with the visible light.

> The first (*a*) is a very pale amethyst colour, so pale, indeed, as to appear almost colourless when fitted in spectacles or pince-nez. The second (*b*) is a medium neutral tint designed to cut down the glare as well as to absorb the harmful rays. To describe the scientific properties in terms of every day experience, we say that, when the (*a*) shade of Crookes glass is used, objects appear as usual in their natural colours, but the eyes are entirely shielded from the dangerous chemical rays and nearly half of the heat rays. When the dark or (*b*) shade of glass is used, objects still retain all their natural colours, but all glare is removed, besides the harmful rays. . . . The (*a*) tint is recommended for general wear, being to all appearances just

> like a colourless lens; and also, for reading by electric light, *even when reading glasses are not usually needed, to safeguard the eyes from electric ophthalmia.* The smoke or (*b*) lenses should be used for sheltering the eyes from excessive visible rays.

So what it comes to is that the electric light is so noxious to eyesight that, in its presence, glasses ought to be worn to protect the eyes from its malign influences. Nature surely never contemplated that we should all be compelled to use protectors to vision in order to permit the employment of a light which (without that protection) deteriorates eyesight. Fancy seeing, everywhere we went, nothing but spectacled people! That is more than can be endured even to give the electric light universal use by displacing lighting agents that are less harmful to the eyes.

Small Talk in the "Electrician."

In the "Commercial and Industrial Section" of the "Electrician," there is a paragraph headed "Gas and the War." The writer of the paragraph has been "reminded" by an attractive pamphlet issued by the Gas Light and Coke Company that gas is having a constructive, as well as a destructive, influence on the war. So far no objection—not even to the acknowledgment of a little forgetfulness that the gas industry is taking more than ever to-day a very important part in national affairs, and thereby is disseminating the information among manufacturers that gas is an important agent for them in accelerating and increasing production, as well as in improving quality by the ability to quickly obtain requisite temperatures, temperature uniformity, and temperature adjustability. This has nothing to do with the important position that the gas industry also occupies as the provider of raw materials for other industries. But the "Electrician" writer goes on to observe: "We do not often refer to publications emanating from this source, *let alone to speak approvingly of them.*" This suggests prejudgment; and a cherished but mistaken idea that nothing good can come out of Horseferry Road. Then there is an indication that the paragraph was penned by the office boy, for we read: "The war has raised *even* gas to the level of electricity." The war could do nothing of the kind. Gas has never admitted that in utility as a domestic and industrial agent, it was at such a low level as electricity. In traction, it has never seriously vied with electrical energy; but in other applications, it takes anything but second place. Before the war gas possessed undeveloped potentiality, and the war has supplied the opportunity for proving this promptly and to an extent which, in the ordinary course of things, would have taken some years of propaganda work to effect. From manufacturers, for example, orders—some of them valued at four figures—for gas-furnaces, large and small, have been sent in without canvassing. A new era has set in for gas in industrial heating; and the gas industry will henceforth from the circulated knowledge reap benefit in increasing volume year by year. Was it not in the "Electrician" supplement that someone went into ecstasies only a short time since over the supersession of gas by electricity for heating dies in some small operation, where there had been use of gas in a manner that evidently was not in the best form—that is to say, judging from the statements made in our contemporary?

The Point-Five Tariff.

The writer of the article on the "Point-Five Tariff" in the "Electrical Review" has given the second instalment, which shows further how deficient is rateable value as a basis for the fixed charge. He gives the following as an example: A consumer subjected to 12½ per cent. fixed charge on £50 rateable value and charged ½d. a unit. for all consumption, would have his total liability fixed on the following scale:

Consumption per Annum.	Energy Charge.	Total Charge.	Mean Price per Unit.
500 units	250d.	1750d.	3·5d.
1000 "	500	2000	2·0
1500 "	750	2250	1·5
2500 "	1250	2750	1·1
5000 "	2500	4000	0 8

This table shows that although the consumption of extra units increases the total bill but slowly, it reduces the mean price per unit rapidly. If a consumer chooses to consume more energy without exceeding a certain maximum demand, there is every reason why he should receive his whole supply at an appreciably lower average price; but there is no justification for charging Messrs. A, B, and C at the average rate of 1·1d., 1·5d., and 1·9d. per unit respectively for equal annual consumption of 1500 units in each case, just because they live in houses assessed at £30, £50, and £70 respectively. The writer asserts that the rateable value tariff must already be responsible for many grave anomalies between the current consumption and the bills of individual consumers; and such anomalies cannot be good for the industry as a whole. He concludes that a rational system would be to make the fixed charge depend entirely on the maximum demand.

Facilities for the study of designing in steel-work and reinforced concrete are provided on Thursday evenings at the London County Council's School of Building, Ferndale Road, Brixton. The advances made in structural engineering, and the London County Council's new regulations for reinforced concrete, have created a growing demand for young engineers and architects with practical training in the theory and design of structures. The class is conducted by Mr. R. Graham Keevill, A.M.I.M.E.

WORKMEN'S COMPENSATION STATISTICS.

What is presumably an effect of the recent conclusions as to the advisability of economizing on the production of periodical Government publications, is to be seen in the annual statistics regarding the Workmen's Compensation Act, 1906, and the Employers' Liability Act, 1880, which, "in consequence of the war," have just appeared, for the year 1914, in the form of a sixteen-page White Paper, instead of, as formerly, in the shape of a Blue-Book running to sixty and more pages.

In connection with the operation of the Compensation Act, particulars have again been prepared of what has occurred in the twelve months under review in the seven great groups of industries—mines, quarries, railways, factories, harbours and docks, constructional works, and shipping. The number of employers from whom returns were received in these seven groups of industries was 129,925; while the aggregate number of persons who came within the provisions of the Act as being employed in the industries was rather more than 7 millions—a falling-off of about half-a-million as compared with the previous year being, no doubt correctly, attributed to the large number of men who joined the Colours in the latter part of the year. During 1914, compensation was paid in 4216 cases of death, and 437,900 cases of disablement; the payments for compensation amounting to £679,732 for fatal accidents, and £2,785,629 for non-fatal ones. It is pointed out that, notwithstanding the disorganization of industry caused by the outbreak of war during the last half of the year, the total amount of compensation [£3,465,361] shows an increase over the figure [£3,361,650] for the preceding year. This is mainly due to payments in respect of the Senghenydd colliery disaster, in which 440 lives were lost, and to the growing accumulation of long-standing cases in which the payments are continued from year to year. As a matter of fact, a comparison of the present figures with those of previous years shows that in these groups of industries there has since the passing of the Act been a steady increase both in the number of cases in which compensation has been paid, and in the actual amount of compensation. In 1909, for instance, there were 335,953 accidents, in respect of which £2,274,238 was paid. It is calculated that, including the costs of management, commission, legal, and medical expenses, the total charge of the Act upon the seven industries named was not less last year than the £5,000,000 at which it was estimated for 1913.

Over the whole of the industries, the annual charge for compensation per person employed averaged 9s. 9d. for 1914, as compared with 8s. 11d. in the year before. Factories occupy the best position in the list, with 5s. 2d. per person; mines being heaviest with 28s. 7d. In connection with quarries, the charge was 11s. 5d., and for constructional work 14s. 11d. There are included in the figures given, in addition to accidents, cases of the various industrial diseases which come within the range of the Compensation Act. In the seven groups of industries compensation was paid in 43 fatal cases to the amount of £7099, and in 9622 disablement cases to the amount of £182,551. No less than 92·4 per cent. of these industrial disease cases occurred in connection with the mining industry; while of the remainder, 544 were cases of lead poisoning.

Glancing at the figures relating to accidents in mines, it is seen that the total number of persons employed last year was 1,046,357, of whom 6299 were females. There were 1768 fatal accidents, and 179,899 cases of disablement. The compensation paid in respect of the former was £307,035, and of the latter £1,024,054. In connection with industrial diseases, there were no fatal cases; but 8928 cases of disablement occurred, involving payment of £164,833. Adding these figures together, a total is arrived at as the compensation paid in the mining industry during the twelve months of 1914 of £1,495,922, as compared with £1,351,258 for the preceding year.

From a table which is given with regard to the duration of compensation for accidents, it is gathered that during last year the cases lasting two weeks and less than three weeks accounted for 32·94 per cent. of the total number; and those lasting four weeks and less than thirteen weeks, for 34·28 per cent. No more than about 1½ per cent. of the cases lasted 26 weeks and over. Cases terminated by payment of a lump sum are not taken into account in these calculations. They are usually in regard to accidents in which the disablement is likely to last for a considerable period; so that by their inclusion the proportion of long duration cases would be increased.

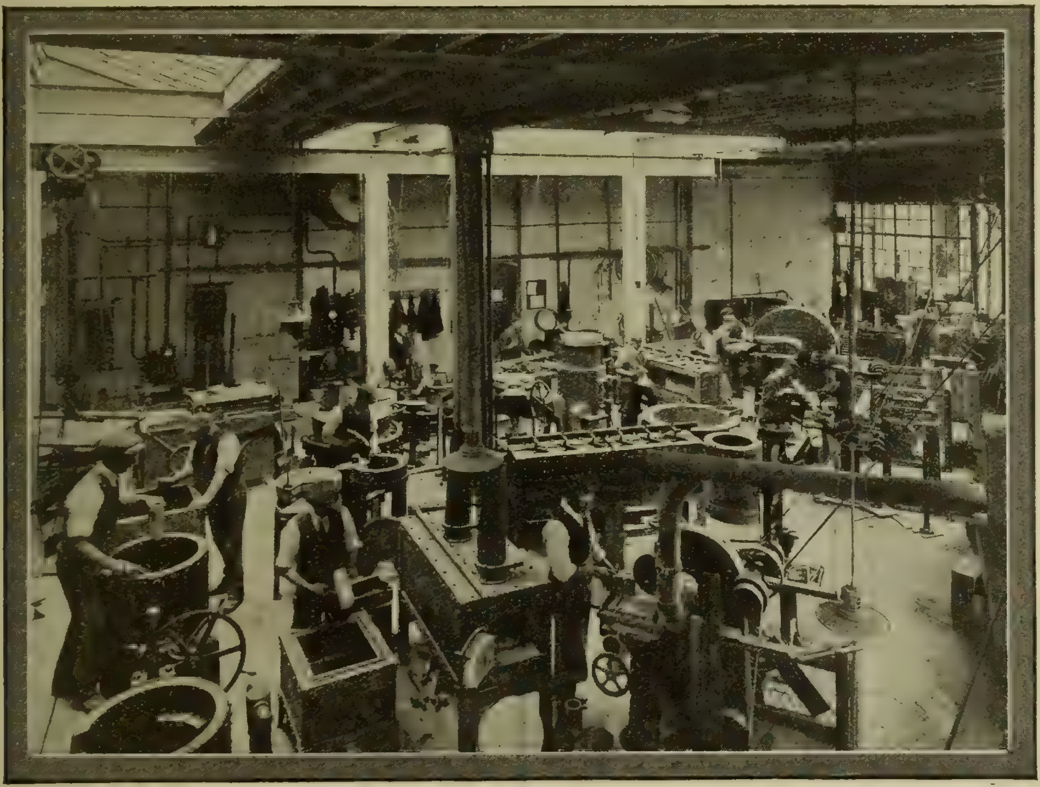
The statistics in Part II. of the report relate to proceedings in the Courts. These show that the number of cases under the Compensation Act which were taken into Court in 1914 was 9746. Some of these, however, were for dealing with allowances already granted, and many were settled out of Court or otherwise disposed of; so that the total number of original claims for compensation finally settled in Court was only 5531—80 per cent. of which were decided in favour of the applicant. The total number of cases under the Employers' Liability Act taken into Court in the whole of the United Kingdom was 139. The figures have been steadily diminishing since 1907, when the number of cases was 604. As is remarked in the report, this condition of affairs clearly indicates the tendency of the remedy that was provided by the older Act to fall into disuse since the Compensation Act of 1906 came into full operation.

GAS APPARATUS FOR MUNITION WORK.

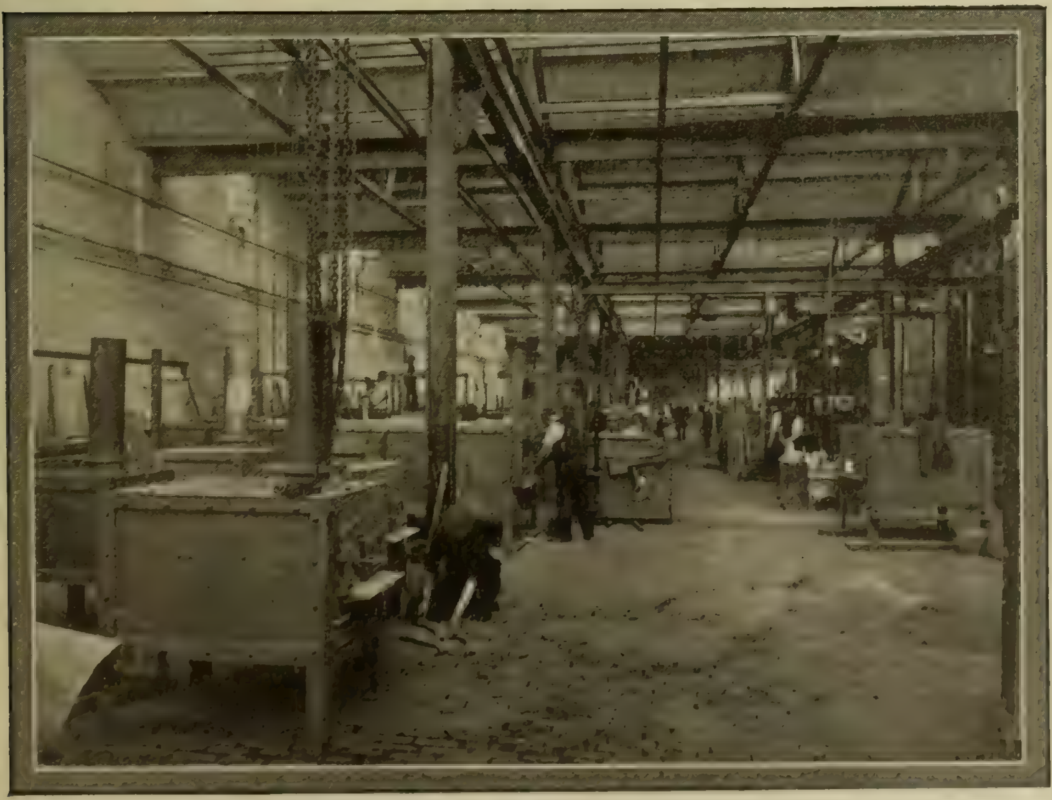
A STRIKING object-lesson regarding the very large amount of gas apparatus that is being steadily called for to carry on munition work throughout the country, is afforded by the accompanying photographs, just taken, of two of the shops in the Furnace Department of Messrs. John Wright and Co., of Birmingham.

No. 1 furnace-shop is used principally for erecting special apparatus; and it is crowded with every variety of gas apparatus for munition work. Among the various furnaces in course of erection may be seen two nosing furnaces for 5-inch shells, two rotary furnaces for heating open ends of 3·3-inch shells, four rotary furnaces for annealing fuse parts before stamping, three tilting furnaces for melting aluminium for fuse parts, &c., a patent crucible furnace for melting copper and brass alloys, a double-ended oven furnace for heating steel billets, a large gas-heated pan for use in connection with the filling of high-explosive shells, an oil-bath for tempering automatic-machine tools, and a tool forge.

The No. 2, or "Holborn Hill," Furnace-Shop, as will be seen, is used for putting together the very large types of gas-furnaces. The photograph shows a considerable number of standard oven-furnaces in course of erection, one of these being 12 feet in length. Many of these furnaces have been supplied to large engineering firms for annealing brass strip and rod metal, cartridge clips, &c.



INTERIOR OF ONE END OF No. 1 FURNACE-SHOP.



THE No. 2, OR "HOLBORN HILL" FURNACE-SHOP.

Coal and Coke Exports.—The War Trade Department announce that, in order to prevent speculative applications for licences for the export of coal and coke, it will be necessary, on and after Nov. 1, for each application for a licence to be accompanied by a declaration to the effect that the proposed shipment is in pursuance of an existing contract, or in execution of a definite order for coal or coke. A revised form of application is now in course of preparation, and will contain the declaration required.

THE BERLIN CITY GAS-WORKS AND THE SUPPLY OF COKE.

The situation of the Berlin City Gas-Works was referred to at some length in a communication published in the columns of one of the principal German commercial newspapers, "from a correspondent in the German capital."

It appears from a discussion which has arisen in the city that apprehensions had been entertained that difficulties would be encountered in the supply of coke to the public during the ensuing winter, because the city gas-works will only be able to maintain their deliveries of coke to a very limited extent as compared with former winters. It was, however, obvious, the correspondent remarks, that these obstacles could easily be overcome, as there is no question of any scarcity of coal or coke in Germany—especially as the country is said to be able to furnish considerable quantities to neutral nations. As a matter of fact, the difficulties resulting from the restricted deliveries of coke from the city gas-works have been promptly removed. The Government Mines Administration has published a notice showing that any anxiety respecting the supply of coke in Berlin no longer exists. The negotiations which have taken place at the Ministry of Commerce, which controls the particular collieries owned by the State, have led to the result that the Coal Syndicate of Lower Silesia, the coke-works in Upper Silesia, and the Rhenish-Westphalian Coal Syndicate have undertaken to meet the deficiency incidental to the supplies from the city gas-works. The deliveries will take place at the proper time, as all the interested Syndicates have expressed their readiness to instruct their organizations to arrange for adequate supplies being furnished to Berlin merchants.

It will be noticed that the settlement of the question is not proposed to be effected in the way of the delivery of suitable coal to the gas-works so that the latter would be able to supply the public with coke in the customary manner, but that the gas-works are being passed over by the intention of the Mining Syndicates to deliver coke direct to the merchants. It seems, in fact, the correspondent proceeds to state, that it is proposed not only to deal with the Berlin city gas-works in this manner, but, according to a declaration made by another Berlin newspaper, a number of other German towns are in a similar situation. There is no possible doubt as to the foundation of this intention. During periods of peace the Berlin gas-works, and a large number of other gas-works, have bought considerable quantities of English coal; and they are now to be penalized for having done so. These works have by no means exclusively used English coal, but have also carbonized, besides German, English coal only so far as was required, having regard to recognized commercial principles and to the interests of the ratepayers in times of peace. That this practice was followed was only right and their duty; for in those districts where the freight conditions rendered possible the competition of English coal, the latter was the most important price regulator in the German market. [This argument was used frequently in former years by the "Berliner Tageblatt."] The drawing upon supplies of English coal by consumers in partly meeting their requirements had the effect, where such deliveries were possible, of removing the price monopoly of the German Syndicates, and compelled them to accommodate their prices to those of their foreign competitors, in the same way as they did in the markets of the world.

A few years ago the German gas-works declared that it was precisely this competition which afforded them important protection against the excessive prices which were demanded by the State mining administration in the district of the Saar, where the Government mines produce about 12,000,000 tons of coal per annum. It goes without saying that this competition has constantly been a thorn in the eyes of the German coal producers. But this circumstance does not justify the way in which they are now taking advantage of the condition of war in order to punish the former customers for English coal.

The correspondent further remarks that the Berlin city gas-works are greatly restricted in obtaining supplies of coal—being compelled to make purchases in Moravia, Bohemia, and Poland of coal whose yield of coke is inadequate for the purpose. And while the works are procuring no serviceable coal, the great Syndicates, instead of furnishing them with coal, take away from them the trade in coke, which is naturally a very favourable business to the coal producers in consequence of the considerable profits realized from the make of coke and the extraction of the bye-products. It is obviously desired in this way to compel the gas-works to, in the future, entirely exclude English coal, and to limit their supplies to native coal. The amount saved by the Berlin city gas-works in times of peace through the buying of English coal is now to be lost four times over by irrational working with unsuitable coal—a fact which represents, the correspondent concludes, a salutary lesson which serves as a warning for the period after the conclusion of peace.

The Council of the Society of Arts announce that, until further notice, the hour for the ordinary Wednesday meetings and for the Cantor Lectures will be 4.30 p.m., instead of 8 p.m. This change has been made to meet the convenience of fellows owing to the darkening of the streets at night.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

Autumn Meeting at Birmingham.

The Autumn General Meeting of the Association was held on Thursday last, at the Grand Hotel, Birmingham. Mr. W. J. RENDELL BAKER, of Mansfield, the President, occupied the chair.

LOSSES BY DEATH.

Sympathy was expressed with the families of the late Mr. W. Langford, of Stoke-on-Trent, and the late Mr. Edward Allen.

Mr. J. FERGUSON BELL (Derby) said Mr. Langford was a leading engineer in the Midlands, and was well known. He took an active interest in the Association. He was very approachable; and when he made a statement they could always rely that it represented the facts. Mr. Allen's loss to the gas industry was an irreparable one. It was only a few months since he visited the Midlands; and they all saw him then. He was in the very best of health; and they looked forward to many years' service on Mr. Allen's part. He was always accessible to members of the industry, readily giving advice and assistance. His death must have been a great blow, not only to the Midlands, but all over the country.

Mr. HUBERT POOLEY and Mr. A. T. HARRIS having spoken in similar terms, a vote of sympathy with the relatives of the deceased gentlemen was passed. It was explained that letters expressing the feelings of members had already been sent to Mrs. Langford and Mrs. Allen. In these circumstances, the meeting decided that the vote should be recorded on the minutes.

ELECTION OF OFFICERS.

The SECRETARY (Mr. W. G. S. Cranmer) explained that the Committee submitted the following nominations for vacancies on the Committee, and also for various offices:—

President: Mr. C. H. Webb, Stourbridge.
Vice-President: Mr. George Stevenson, Long Eaton.
Hon. Treasurer: Mr. W. R. Cooper, Banbury.
Hon. Secretary: Mr. W. G. S. Cranmer, Willenhall.
Auditors: Mr. B. Ely, Pye Bridge, and Mr. F. L. Wimhurst, Newcastle, Staffs.
New Members of Committee: Messrs. J. Brettle, R. H. Ainsworth, W. Chaney, and B. W. Smith.

The SECRETARY added that there were no further nominations; and he took it that the gentlemen he had named automatically became the officials for the next twelve months. Personally, he would much rather have seen a number of members nominated for the positions by the ordinary members of the Association. He thought the complaint of secretaries for some years past had been that nominations had not been made in this way, but that they had always been left more or less to the Committee. Some little time ago, they would remember, there were several discussions on the question of the election of officials; and the rules were altered with the idea of giving members more power in this direction. Unfortunately, use had not been made of these opportunities.

Mr. W. C. JONES (Brierley Hill) proposed that the recommendations of the Committee be accepted. He advanced as a reason why no nominations had been received from the general body of members that the selections made by the Committee recently, and especially during the abnormal war conditions, had met with the approval of the members generally.

Mr. FERGUSON BELL, in seconding the motion, congratulated Mr. Webb upon his appointment as President. He agreed with Mr. Jones that the absence of nominations proved that the members were well satisfied with the appointments suggested. They had always been fortunate with their selection of the Association's officers, and he was very glad to find that some of the older members were taking a lead in the Association.

NEW MEMBERS.

The following new members were elected: Messrs. Reginald Thomas, of Droitwich, William Prince, of Tipton, and George Hinson, of Chipping Norton.

GAS-FITTERS' CERTIFICATES.

The SECRETARY said he had a number of applications for certificates sent in by various members on behalf of fitters in their employ. They were, however, only a very small proportion of the number of forms he had sent out to members—at their request, of course. If those who had forms ready filled in would let him have them as soon as possible, he would send them on to Mr. Dunn for consideration by the Committee in London.

A MEMBER inquired whether anything had been done in different parts of the country towards getting certificates for working gas-fitters employed by master plumbers and others, and who were not connected with the gas undertaking of the town—particularly in towns like Birmingham and Burton-on-Trent, where the gas-fitters worked to some extent under the direction of the gas undertaking.

The PRESIDENT pointed out that any application from a local plumber would have to come through the local gas engineer.

Home Sales of Sulphate of Ammonia.

Mr. A. G. Leighton, of the Sulphate of Ammonia Association, then read a paper which was on the lines of that contributed by Mr. F. C. O. Speyer to the North British Association last month. [See "Journal" for Sept. 7, p. 512.] In the course of the discussion which followed,

Mr. Ferguson Bell congratulated Mr. Leighton and the Sulphate of Ammonia Association on the pioneer work which was being done. There was no doubt that in the past they had not brought the merits of sulphate of ammonia so prominently before agriculturists as they ought to have done. He thought that Mr. Leighton had put his finger on a weak spot when he pointed out that they could not do a wholesale and a retail trade. Gas companies had in some cases sold to farmers and ignored the local merchants. But this was a step in the wrong direction. They should sell to the local corn merchants, and try to persuade them to become their agents. They must, of course, be allowed a reasonable profit; and the amount suggested, 10s. a ton, seemed to him a very fair one. There was a difficulty in regard to prices; and he considered Mr. Leighton's suggestion was a good one—namely, to try and have meetings for the different districts to fix prices from month to month, or three months to three months. They did not want prices to fluctuate too much—in fact, the more they could steady prices the better. He thought the Sulphate of Ammonia Association could help them if they would offer prizes and cups to the different local agricultural societies, and especially to farmers who grew crops by means of sulphate of ammonia as one of the artificial fertilizers. The question of bags was one that the Association should take up. They might supply a bag with a good advertisement on it. The principal point that Mr. Leighton wished to drive home, however, was that they should popularize their own make of sulphate. It was no good making sulphate of ammonia unless they could find buyers; and the only way to find buyers was to let the merits of sulphate be known. He thought the Association that Mr. Leighton represented were doing very good and very important work. In fact, if he might say so, there had been a distinct improvement in the business methods of the Association during the last twelve months. He did think that they ought not to use second-hand or old bags, but prepare their salt in bags of good, marketable quality, and suitable for use by the farmers. He believed that our enemies, the Germans, were ahead of us in this respect. They turned out many of their products in a more pleasing and marketable way than we did. We should take this lesson to heart now that there was an excellent chance of popularizing our productions.

Mr. Percy H. Fletcher (Evesham) said he disagreed with the reader of the paper when he suggested that sulphate of ammonia should be sold by corn merchants. If they wanted to sell an article, he could not conceive why they should take it to a person who had got a dozen different articles that did the same work, and expect him to sell theirs in preference. It was a question of which production he got the most profit out of. He had never found farmers or market gardeners the ignorant people that they had been set down to be. The majority of them knew well the value of manure, and, further, they did not buy much which they did not have analyzed. In his district, nitrate of soda and sulphate of ammonia were not used for the same purpose at all. It was possible to see the action of nitrate of soda in two days; but it did not do on all soil, and they did not use it now because of its action on the land. It set the soil hard. He found the farmers well posted as to what they were going to use. His opinion was that sulphate of ammonia should be sold direct. Let them get into direct touch with their customers, and see that they were fully satisfied.

Mr. A. Bird (Bromsgrove) mentioned that a large farmer in his district who had used sulphate of ammonia on a crop of potatoes had found the yield three times greater than where manure had been used.

Mr. J. T. Lewis did not agree with Mr. Bell's suggestion that the Association should supply bags. This hardly seemed necessary in the case of sulphate for home consumption. For export, there would be something to be said in favour of the provision of bags, because, after all, the importance of a new bag properly marked was greater if the consignment was going abroad than if they were sending it to a farmer immediately adjacent to their own works. Nor did he agree with Mr. Fletcher, that they should sell to farmers direct. His attempt to deal with farmers direct had not been satisfactory. Some of them took a tremendous time in paying the accounts for the sulphate when they got it. If they could get a good agent—he might be a farmer, or a man of some standing among farmers, or a corn merchant—he believed it was better to sell to such an individual. They gave him a direct interest to sell to farmers by offering him the 10s. It was important that they should create, if possible, a greater demand at home for the sulphate they manufactured.

Mr. J. S. Cranmer (Stratford on-Avon) said that in his case they sold direct to the factor; and he found that this was the best plan. If they sold to the farmer, they had to wait for the money—sometimes they got it, and sometimes they did not. He thought the question of bags was of very little consequence. So long as he got a good bag to hold the sulphate, he did not trouble further. It was not as if the stuff was going abroad. He could always sell all the sulphate he made; and he had no trouble in doing so.

Mr. G. Helps (Nuneaton) agreed that it was an excellent thing to attempt to sell through the factors. The farmers wanted twelve months' credit at least.

Mr. A. T. Harris did not see how prices could be fixed month by month. As to the farmers, he found that they were not quite so black as they had been painted. If there was undue delay in payment, it was the fault of the sellers, because he thought the farmer, if he had a distinct understanding that he bought stuff at an advantage by paying within a certain time, was quite willing to "put a bob into his pocket." In his case, they sold the bulk of their production to factors; but he had an arrangement with them that he would never undersell them to a farmer. So that the farmer reaped no benefit by coming direct to him. He did not agree with Mr. Bell as to the bags. Everything, he thought, depended upon the local circumstances. They did not want to take the factors' business away from them. At the same time they did not want to let business slip from their hands when the factor was trying to get more than a reasonable profit.

A Member asked whether anyone could inform him of a method by which sulphate of ammonia could be produced in a flour or ordinary salt that could be put straight into the bag. Much of his output had to be broken up before it could be sent away.

Another Member contended that the farmer must be given some consideration in regard to payment; he did not get crops quarterly.

Mr. Leighton, dealing with the points raised in the discussion, fully agreed with Mr. Bell that if they could fix prices for three months it would be much better, so far as the home trade was concerned. As to prizes, he mentioned that the Sulphate of Ammonia Association were giving something like £250 or £300 in a special prize competition. One member had spoken of the results he had obtained by the use of sulphate of ammonia. He thought he might say that in Ireland they had just judged for a competition a crop of potatoes producing 24 tons 5 cwt. 3 qrs. 18 lbs. with an expenditure of 1½ cwt. of sulphate of ammonia, as compared with only 17 tons 3 cwt. from untreated land. He also agreed with Mr. Bell on the question of bags. There were parcels of sulphate of ammonia sent out by producers in this country which made him ashamed to say that he was associated with the production of the article. This did not give the farmer a good impression. He suggested the adoption of a standard bag, and mentioned that this question had been before the Association; and it had now been pretty well decided to buy bags and brand them: "Sulphate of Ammonia. For all crops." These would have been sold to members at cost price; but it so happened that bags at the present time were just about as dear as they could be, and it would be a very bad investment to buy thousands of them now. The bags could be made of such a size as to be useful later to the farmer. With regard to Mr. Fletcher's criticism, he said there were many merchants attending Evesham Market every week from the surrounding towns who were selling an enormous amount of nitrate of soda. If sulphate of ammonia was applied six weeks in advance, it answered the same purpose as nitrate of soda put on seven days in advance. It was only a question of instructing the farmer with regard to the earlier use of sulphate of ammonia. As to the 10s. profit, he agreed that it was not sufficient if the farmer had to give credit; but this profit was arranged on a cash basis. Although 10s. was mentioned as the amount, it did not prevent the corn merchant judging a particular customer saying: "You take nine or twelve months' credit, and I will have a pound out of you." There were plenty of corn merchants who would not mention sulphate of ammonia to a man, simply because they felt that their position was insecure on account of the producer cutting the trade from under their feet. It was very improbable that corn factors would have the enthusiasm to sell goods to farmers if producers took the best customers and left them the worst. He was opposed to producers dealing with farmers' co-operative societies. The societies were not very strong yet; and it must be remembered that the corn factors were as much against co-operative societies among farmers as gas producers were against electric works, and they must not favour one more than another. If there was a recognized co-operative society trading in things appertaining to the farm, he should treat them on exactly the same terms as the corn factor, but no better.

On the motion of Mr. George Helps, seconded by Mr. F. Lee (Hinckley), Mr. Leighton was warmly thanked for his address.

Informal Discussions.

Subsequently informal discussions took place, upon "Toluol Recovery," opened by Mr. Hubert Pooley, of Leicester, and on "War and Gas-Works Labour," introduced by Mr. W. H. Johns, of West Bromwich. It was determined by the Committee of the Association that both these items should be treated as private matters, and not reported.

Southern District Association of Gas Engineers and Managers.—The annual general meeting of the Association will be held at the Hotel Cecil on Thursday, Nov. 11, at 4.30, and will be preceded by afternoon tea, at 3.30. Papers will be read by Mr. W. D. Child on the "Construction of Concrete Purifiers at Romford in 1913," by Mr. F. Livesey and by Mr. R. Wardell on the "Working of Tar Dehydration Plants," and (it is hoped) by Mr. F. Durkin, of Southampton. There will also be an informal discussion on the production of toluene, which will not be reported.

PRESIDENT'S ADDRESS TO THE MEMBERS OF THE PACIFIC COAST GAS ASSOCIATION.

Another Speech by Mr. E. C. Jones.

Last week, p. 90, there was given the text of the address presented by Mr. E. C. Jones to the opening meeting of the International Gas Congress at San Francisco. During Congress Week, Mr. Jones was called upon for a second address—in his position as President of the Pacific Coast Gas Association. We reproduce the main portions of it.

The long-anticipated year 1915 finds the Pacific Coast Gas Association assembled as the host to the International Gas Congress. For years we have hoped and planned to bring together, in our beloved City of San Francisco, during the period of the Panama-Pacific International Exposition, a gathering of gas men representing every part of the world, where their efforts have carried light, heat, and power for the benefit of mankind.

The International Gas Congress was launched at our Oakland meeting in September, 1911; and it immediately received the support and encouragement of the entire gas fraternity. During the past year we have been beset with grave discouragements, with which we in California are so familiar—beginning with financial depression and industrial uncertainty, and culminating in the greatest war the world has ever known—a war engaging nearly all the great nations of the world, and of such magnitude that it makes the losses and horrors of all the wars in history seem as nothing. These conditions would have deterred any but Californians from holding an unrivalled and successful International Exposition in commemoration of the completion of the world's greatest engineering feat—the building of the Panama Canal. But, with intrepid zeal and cheerful confidence, this wonderful people—with the blood of the pioneers in their veins, and tried and not found wanting by earthquake and fire—forged ahead to success with the plans of the exposition; and this Association has joined in the spirit with the feeling that while the attendance at an International Gas Congress might not be as large as anticipated, it would bring together a representative gathering of gas men.

While the deplorable war has made it impossible for foreign gas men to be present, we feel that we have the best wishes for success of all the Gas Associations of the world, and that their members are with us in spirit. How fortunate we are to meet in this beautiful Exposition City and enjoy the blessings of peace.

THE SUPPLY OF OIL GAS.

The oil-gas business of California has prospered during the past year; and the steadily increasing production of crude petroleum has warranted the building of permanent plants, and the development of this unique and almost local method of making gas. At the time of the organization of our Association in 1893, there were a few water-gas plants in California, and the rest were coal-gas works in the various stages of the building-up of the art from iron retorts to full depth regenerative benches. The production of petroleum in California in 1893 was 470,179 barrels. By rapid strides during the life of our Association, the production of petroleum has increased until, in 1914, there were 102,881,907 barrels produced, and every foot of gas manufactured in California was made from oil.

Many years ago it was said that the crude petroleum of California would prove a greater blessing than the rich yield of gold which has made the State famous. This prophecy has been fulfilled; and the abundant oil supply, besides furnishing a cheap and ideal crude material for gas-making, is advancing the industrial importance of our State.

CALORIFIC VALUE NOW THE VOGUE.

One of the most important subjects now before gas people is the substitution of the heating value of gas for the candle power standard. The day of the open-flame burner is past; and the only excuse for candle power was to make the use of this wasteful and inefficient burner possible. Comparatively low candle power is sometimes stipulated by regulating bodies for the purpose of insuring a high heating value of gas; but if the standard heating value is placed high enough (say, 600 B.Th.U. per cubic foot as a minimum), candle power may be safely ignored, and the consumer of gas will be benefited by being spared the annoyance of naphthalene stoppages, smoky flames, and inconstant quality.

It should be the personal duty of every member of our Association to use his influence to bring about the adoption of a heating value standard of gas, for the mutual good of both the consumer and manufacturer of gas.

WORKMEN'S ACCIDENTS.

The introduction of the principle of "Safety First" into our industry has wrought wonders in the prevention of accidents to our fellow workmen. This movement is on the same humanitarian plane as the work of the Red Cross Society; and its disciples are the heroes of peace instead of the heroes of war. "Efficiency first" has been the slogan of industrial establishments before the advent of the safety campaign; but by a mingling of heart work with head work, the result is prevention of suffering and disability, restraint of careless workmen, and improvement in housekeeping, which bring higher efficiency and better workmen. It creates a feeling in the individual that he amounts to something and is worth taking care of. Our gas-works are cleaner; the scrap-heaps have disappeared; and the efforts for safety are rewarded by actual economy.

The effectiveness of "Safety-First" work is shown in a report of one of the large gas undertakings on the Pacific Coast, which has an organized system of prevention and correction by committees. The fatal industrial accidents during 1913 were 16; while in 1914 there were 8—a reduction of just one-half. In 1913 there were 822 industrial accidents reported, as against 695 in 1914. This is a remarkable showing, when it is considered that the Workmen's Compensation Act was not in force in 1913, and in 1914 the workings of this law necessitated the reporting of trivial accidents which would have been entirely overlooked before the law went into effect.

Many of the hysterical features of "Safety-First" work in the beginning have already worn-down to their bearings; and the work is now proceeding along saner lines with better and more permanent results.

THE GAS EXHIBITS.

The "Collective Gas Exhibit" at the Panama-Pacific International Exposition is the first collective exhibit of the gas industry at any International Exposition. The idea originated with the American Gas Institute, whose Committee interested the manufacturers, and disposed of the spaces in the exhibit—thus securing its financial success.

The exhibit occupies 10,000 square feet of space in the northwest corner of the Palace of Manufactures; and the construction of the fine pavilion and the work of conducting the exhibit have been done under the management of a Committee of the Pacific Coast Gas Association, of which our Vice-President, Mr. Frank A. Cressey, jun., is Chairman.

CONCLUSION.

After referring to the awards in connection with the gas part of the exhibits, and alluding to the deaths that had occurred last year in connection with the Association, Mr. Jones concluded his address with these words: "Your President urges faith in the gas industry—faith accompanied by an aggressive spirit to increase the extent and glory of our business, and never rest until our product is universally used for every purpose, domestic and industrial, in a field which belongs to us, and competition should only serve to stimulate us to renewed efforts."

SIXTY YEARS AGO.

From the "Journal" for October, 1855.

Notice to Subscribers.—We some months since announced that we had under consideration a project for the conversion of this "JOURNAL" into a bi-monthly publication of sixteen pages, whenever it appeared to us that materials could be depended upon for such an extension. The numerous supplements and enlarged numbers we have from time to time been compelled to give to keep up with the accumulation of matter, satisfies us that the time is approaching for carrying our project into effect; and we have consequently resolved to commence the new issue in January next, when the subscriptions for the current year will have expired. In making this announcement, we cannot refrain from expressing our gratitude for the favour with which our exertions to establish an independent organ for the circulation of information interesting to an important branch of our national industry has been received; and we pledge ourselves to spare no exertion or expense to render it worthy of the extensive support and confidence it enjoys.

Statutory Powers.—The period is close at hand for giving notices of intended applications to Parliament during the session of 1856 for the incorporation of joint-stock companies; and we again urge upon unincorporated gas companies and private owners of gas-works, the advantage of obtaining statutory powers for carrying on their operations, as some protection against the pressure brought to bear on them by local bodies whenever an opportunity offers for wringing some concession from their fears. The vicious system of supplying public lights at less than the prime cost, has been, to a considerable extent, fostered by the irregular manner and uncertain tenure upon which many parties have invested their capital in gas-works, and who, to save a portion of their property from confiscation, which would have been the result of competition, have from time to time submitted to exactions repugnant alike to the sound principles by which commercial transactions should be regulated, and to common sense. Instances come before us every day of sacrifices thus made, which a few hundred pounds invested in obtaining Acts of Incorporation would have prevented; and each successive year increases the severity of the conditions imposed upon applicants for Gas Acts. A maximum price, which may be deemed by the Legislature to be reasonable this year, may not be so considered next; and hence those who delay taking the requisite steps for strengthening their position this year, may find the obstacles greater in succeeding years.

PRODUCTS AND BYE-PRODUCTS OF COAL.

A Canadian Bulletin.

There has been submitted to the Canadian Department of Mines a bulletin, on the "Products and Bye-Products of Coal," prepared by Mr. Edgar Stansfield, M.Sc., and Dr. F. E. Carter, B.Sc., the subject-matter of which is divided into two parts: The production of coke, gas, ammonia, and tar from bituminous coal; and the properties and uses of these products and bye-products. Other fuels than bituminous coal are dealt with, but only in a tentative way, since bituminous coal is of overwhelmingly greater importance than any other fuel as a medium from which to obtain the commercial products particularized in the first part. In setting forth the results of these investigations, the aim has been to give prominence to the commercial rather than to the scientific aspect of the subjects treated—more especially as regards their bearing on existing conditions in Canada.

The present time, it is remarked, is particularly opportune for discussing the question of establishing new lines of trade and commerce; for, on account of the deplorable war conditions in Europe, all industries are more or less dislocated as regards supply and demand, and manufacturers everywhere are taking stock of current conditions, and considering future possibilities. The trade possibility that would naturally occur to most people interested in the commercial development of Canada is the establishment of a coal-tar dye industry; since here, as in other countries, factories using dyes are being seriously inconvenienced, owing to the fact that Germany—by a combination of scientific research, technical ability, and commercial energy—has for years had practically a monopoly in the manufacture and supply of coal-tar dyes, and, consequently, since the opening of the war importation of this commodity from Europe has almost ceased. The importation of dyes into Canada is, however, not large, and the prospect of developing a flourishing coal-tar dye industry is not encouraging. But offsetting this negative view is the encouraging fact that there are other important bye-products from coal which, though not figuring so prominently in the public eye, are nevertheless of much greater importance commercially. A number of these are peculiarly suitable for production in Canada; and the Dominion could thus be rendered less dependent on foreign sources of supply.

The first part of the bulletin, after setting forth concisely the different methods of production of coke, gas, ammonia, and tar, goes on to compare types of coke-ovens. Until recent years, it is said, there has been a decided prejudice against retort-oven coke. The product of beehive ovens has been more in demand, especially for use in blast-furnaces. This preference, however, is fortunately disappearing. As a matter of fact, retort-ovens can make as good coke as beehive ovens, and can make more of it from ordinary coking coals. They have, moreover, a wider range of adaptability, as they can produce a commercial coke from certain classes of coal which cannot be coked in a beehive oven. Hence the retort-oven is gradually displacing the beehive oven; and in some countries the change is almost completed.

Beehive ovens, as a rule, are a nuisance in the neighbourhood where they are located. They burn or waste all the gases and volatile matter generated from the coal; and they give no return except that of the coke they produce. Moreover, they also burn about 10 per cent. of the coke itself. In other words, if, with a certain coal, a 75 per cent. yield of coke is obtained in a retort-oven, probably only 65 per cent. would be obtained in a beehive oven. In the former case, 134 tons of coal would be required to produce 100 tons of coke; whereas in the latter case 154 tons would be required. That is to say, for every 100 tons of coke produced in a beehive oven, 20 tons of coal, approximately, are needlessly wasted through the burning of the coke. From the ethical point of view, therefore, there can be no hesitation in condemning the beehive oven; while from the practical point of view it should be remembered that, in addition to the smaller yield, the greater waste of carbon in the beehive oven results in a higher percentage of ash in the coke produced. The beehive oven has the further disadvantage that the coking period is at least one-and-a-half times as long as in a retort-oven; so that, if the charges are the same, it takes three beehive ovens to do the work of two retort-ovens. The cost of working a beehive oven is also high, as the method of drawing the coke by manual labour is slow and expensive. The beehive oven is, however, very low in first cost, and being simple in construction is also easy to keep in repair. These facts, together with the widespread prejudice in its favour, and the great number of managers and men familiar with its use—but unfamiliar with retort-oven practice—explain the reluctance of so many coke manufacturers to adopt retort-ovens. It is probable that in nearly all cases the non-recovery retort-oven is, in the long run, more profitable than the beehive oven; and that it would certainly prove to be so in all large plants. The capital outlay is greater, but the working expenses are less; while the output of coke is at least 10 per cent. more for the same amount of coal used.

In Canada, at the present time, the profits to be gained by the recovery of bye-products are more doubtful. On account of the high capital cost of a bye-product plant, it is essential that there should be a reasonable certainty of working full time. Hence it is usual to erect large central plants, where they are capable of drawing supplies from several collieries, and where a good market for the products is easy of access. It seems certain that bye-product recovery coke-oven plants which produce tar, and the coal-tar industry which uses coal tar as a raw product, must grow up together. At the present time, there are only two bye-product recovery coke-oven plants operating in Canada. Yet in 1913 these two plants were responsible for two-thirds of the total coke production of the Dominion. As coke is imported, however, their production only amounted to one-half the total consumption of coke in Canada.

No official statistics are available to show the weight of coal coked annually in Canadian gas-works, and the corresponding yield of gas, coke, &c.; but Mr. A. Hewitt, the General Manager of the Toronto Consumers' Gas Company, states that approximately 5,000,000 gallons of tar are produced annually. Some idea of the relation between the coal coked and the products obtained at modern gas-works can, it is said, be obtained from figures published in the "JOURNAL OF GAS LIGHTING," showing that the average residuals obtained in 1913 by the three London Gas Companies per long ton (2240 lbs.) of coal coked were: Coke, 12·47 cwt.; coke breeze, 5·20 bushels; tar, 10 gallons; ammoniacal liquor, 36·11 gallons of 8 oz.; gas, 12,420 cubic feet. The ammoniacal liquor referred to is of such a strength that 8 oz. of pure sulphuric acid are required to neutralize the volatile ammonia in 1 gallon of the liquid. This corresponds to 0·674 lb. of ammonium sulphate per gallon; but the actual yield obtained is not stated. Although the above are called residuals, it is obvious that the weight of coke stated is the gross yield, rather than the net weight left after heating the retorts. The three companies in question used approximately 20·3 per cent., 21·1 per cent., and 12·3 per cent. respectively (mean 18 per cent.) of the coke produced to heat their retorts. Subtracting 18 per cent. from the above coke yield, and assuming that a bushel of coke breeze weighs 50 lbs., then the net yields per 100 lbs. of coal coked are approximately: Coke, 60 lbs., tar 0·45 gallon, gas 550 cubic feet, ammonium sulphate 1 lb.

The data collected by the Division of Mineral Resources and Statistics of the Mines Branch, show that, in 1913, 2,147,913 short tons (2000 lbs.) of coal were carbonized in Canadian coke-ovens, and 1,517,133 tons of coke produced therefrom. Of the above, 1,456,361 tons of coal were coked in bye-product recovery coke-ovens, with the production of 1,018,632 tons of coke, 8,371,600 gallons of tar, 10,663 tons of ammonium sulphate, and 3,353,831,100 cubic feet of surplus gas. The corresponding yields per 100 lbs. of coal are: Coke, 70 lbs., tar 0·29 gallon, gas 115 cubic feet, ammonium sulphate 0·73 lb. These figures are not comparable with those from the London Gas Companies, as no analyses of the coal coked are given in either case.

No statistics of the output of producer gas in Canada are so far available.

In the second part of the bulletin, the properties and uses of coal products and bye-products are explained in a useful manner. As to coke, it is pointed out that recovery coke-oven practice yields a proportionately larger supply of solid as compared with gaseous fuel than is the case with ordinary gas-works practice, because at the coke-ovens gas is used to supply the heat for coking, while at the gas-works coke is used for this purpose. Modern bye-product recovery coke plants have recently been installed in certain places as a means of supplying city gas; but such installations are only possible where there is a good demand for metallurgical coke. A study of the statistics of coke suggests that, in some Canadian cities, a coke-oven plant might possibly prove more profitable than a gas plant. During 1913, the coke imports exceeded the exports by 655,671 tons—an amount greater than the coke production of either of the two bye-product coke-oven plants. In 1913, 1,517,133 short tons of oven coke were produced in Canada, and 1,530,499 tons were sold or used by the producers. The exports amounted to 68,235 tons, and the imports to 723,906 tons.

The table gives actual analyses of a city gas, a coke-oven gas, producer gas, and, for comparison, a natural gas. The calorific values are in British thermal units per cubic foot of gas measured moist at 60° Fahr., under a pressure of 30 inches of mercury. The assumption is made that the saturated hydrocarbons are all methane, and the unsaturated hydrocarbons ethylene. This

Examples of Gas Analyses.

—		City. Gas.	Coke-Oven Gas.	Producer Gas (Coal).	Natural Gas.
		1.	2.	3.	4.
Hydrogen	per cent.	39·5	48·5	12·5	..
Saturated hydrocarbons	,,	31·8	32·8	3·3	91·6
Unsaturated hydrocarbons	,,	5·1	3·6	0·2	..
Carbon monoxide	,,	14·6	5·5	10·7	..
Carbon dioxide	,,	1·7	2·4	10·1	..
Oxygen	,,	0·6	0·3	0·8	0·2
Nitrogen (by difference)	,,	6·7	6·9	62·4	8·2
Inflammable gases	,,	91·0	90·4	26·7	91·6
Calorific value:					
By calculation, gross B.Th.U.		574	560	111	916
By calculation, net B.Th.U.		516	500	101	822

No. 1. Montreal city gas, which is coal gas mixed with carburetted water gas.
,, 2. Coke-oven gas from Nova Scotia coal coked in Otto-Hoffman oven.
,, 3. Nova Scotia coal in M'Gill gas-producer.
,, 4. A natural gas from Alberta.

probably causes no appreciable error in the calculated calorific value for a producer gas; but it is liable to cause a serious error in the case of a city gas, and an even greater error when applied to an oil gas. Determinations made with a Boys gas-calorimeter showed the actual gross calorific value of the city gas given in the table as 636 B.Th.U.; and of the natural gas, 930 B.Th.U.

The production of city gas in Canada is largely reduced by the competition of natural gas. There are at present some 39 companies supplying city gas; the net prices charged per 1000 cubic feet for illuminating purposes ranging from 70 c. to $2·40. There are 23 companies employed in the distribution of natural gas; the corresponding prices ranging from 15 c. to 70 c. The production of natural gas in Canada in 1913 was, approximately 20,345,000,000 cubic feet. The output of surplus coke-oven gas in Canada in 1913 amounted to 3,354,000,000 cubic feet.

The uses of gas are touched upon, and then ammonia, cyanides, and tar are dealt with. A particularly useful section of the work is that regarding the commercial products of coal tar; their uses and derivatives being enumerated in some detail. Under the heading of the "Colour Industry," one notes the remark that "it would be a difficult matter, and probably an unprofitable one, to attempt at present to form a coal-tar dye industry in Canada." The Canadian production, exports, and imports of the different materials referred to in the bulletin, for the years 1912 and 1913, are given in a table which brings the work to a close.

PACIFIC COAST GAS ASSOCIATION.

[From Our Own Correspondent.]

Among the Gas Association meetings held in connection with the International Gas Congress was the twenty-third annual convention of the Pacific Coast Gas Association. This body took the first steps towards the congress, and in true Californian style acted as hosts to the Eastern visitors. Every man enrolled for the congress, and in this way guaranteed the financial resources needed for publication and other expenses.

In order not to interfere with the sessions of the congress, the meeting of the Association was confined to one sitting, and to committee reports.

With an attendance of several hundred, the chair was taken at 10.25 a.m., on Sept. 27, by the President, Mr. E. C. Jones, of San Francisco. Mr. Jones occupies this year somewhat the position that Sir Corbet Woodall did in the Jubilee year; for he is also President of the American Gas Institute.

In some introductory remarks, Mr. Jones called to mind that nineteen years ago he had presided as President over the same Association. He attributed the prosperity of the industry on the Pacific Coast in the intervening years to the spirit evinced by his fellow workers. He then called on Dr. Alex. C. Humphreys, as President of the International Gas Congress, for a word of greeting. Dr. Humphreys desired to add his tribute to the spirit of the Coast, the enthusiasm which leads to prosperity. In reply to Dr. Humphreys, Mr. John A. Britton stated that California had often "blazed trails in gas practice."

The Treasurer's report showed a satisfactory balance; and the Secretary reported 354 members, not including 30 subsequently elected by the meeting.

The Directors reported in favour of Santa Barbara, Cal., for the 1916 meeting. It was recommended to appoint a Committee to bring about adequate sizes of house-piping for gas. This action was undoubtedly suggested by the forthcoming report of the Institute's Committee on the subject; and this, in turn, illustrates how one Association can help another.

For the Committee on Gas Engineering, Mr. Britton reported contributions extending for five years, of an annual value of about $3000. These have enabled a full course in gas engineering to be offered by the University of California. A description of this movement, and of the course, appeared in "Gas Age" last August.* In brief, the course is a combination of mechanical engineering and chemistry. Dr. Humphreys, in commenting on the report, said that the Pacific Coast Gas Association should keep in touch with the course at all times, and, as the founders, could always suggest views as to its practical side. In general, in such a course over-specialization should be avoided.

Dr. C. C. Thomas, of Johns Hopkins University, thought they were fortunate in having on their teaching staff a gas engineer who combined practical experience with scientific attainments. They were working to enable the United States to cease its dependence on foreign nations for the bye-products of gas manufacture. Professor Corey, who has charge of the course, said a college education was justifiable only in so far as it trained the mind rather than merely imparting information. He thanked the Association for their material, and to a greater degree for their moral support.

The Librarian reported 104 accessions—making a total of 1202 volumes—and a record circulation during the past year. This is the only Gas Association in this country that has been successful in such use of a library.

The President then delivered his address [see p. 134]. Speaking to the members as hosts of the International Gas Congress, he said that while war had prevented any foreign representations, he felt that their fellow workers in other countries were present in spirit, and that the Association were indeed fortunate in being able to be in San Francisco under peaceful conditions. He spoke of the rapid development of oil gas, and its present firm establishment in California as the sole manufacturing process. He declared that the only use of the candle-power standard had been to make possible the employment of the wasteful flat-flame burner; that a proper calorific standard ensured good gas; and that gas men everywhere should work for such a standard in the interests of both sellers and users. He characterized the "Safety First" movement as mingling heart work with head work. In one large company there had been in 1913 sixteen fatalities, and in 1914 only eight; in 1913 822, and in 1914 695 accidents, and the latter notwithstanding the fact that in 1914 a new law required the reporting of many trivial accidents not recorded in 1913. He referred to the "Grand Prize" that had been awarded by the exposition to the "Collective Gas Exhibit." He called for faith in the industry accompanied by an aggressive spirit until gas was used in every field belonging to it.

Mr. John A. Britton, as Chairman of the Committee on the President's Address, in a few informal remarks, bore testimony to Mr. Jones's unflagging enthusiasm for gas, and his success in establishing a calorific standard in California.

The meeting closed with the election of the office-bearers for next year.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Opening Meeting of the Session.

The Scottish Junior Gas Association (Eastern District) held their opening business meeting for the coming session last Saturday in the Heriot-Watt College, Edinburgh.

The President's Medal.

Mr. R. B. **Chalmers**, the retiring President, on vacating the presidential chair, was presented with a medal to commemorate his year of office, for which he returned thanks.

THE PRESIDENT'S ADDRESS.

The **President** (Mr. J. J. Scott, of Lower Largo), in his opening address, said: I thank you for the honour conferred on me by electing me your President for this year. To-day our numbers stand at 76 ordinary and 14 honorary members, which is quite up to previous years, and augurs well for continued success.

ROLL OF HONOUR.

A "Roll of Honour" is being prepared, as an appreciation of our admiration for those members who have taken their stand for King and Country. At the present time we have the following names to inscribe; and I would mention that there is plenty of room for more.

Lieut.-Col. Henry O'Connor . . .	O/C Inner Defences of the Forth.
Lieut. L. Farquhar (Alloa) . . .	Cameron Highlanders.
Trooper J. H. Bell (Callender) . .	Scottish Horse.
Sergt. A. Leitch (Cardenden) . .	Black Watch.
Private J. B. Scott (Cowdenbeath) .	" "
Private D. D. Bruce (N. Berwick) .	Royal Engineers.
Private J. Lindsay (Dundee) . . .	—
Gunner J. H. Marshall (E. Wemyss)	Royal Garrison Artillery.

Although we cannot all go with them, it lies with us to do what we can in our various spheres to help them in their effort to maintain that freedom of life which we claim as our heritage. It may be that, because of one joining the forces, his work has been divided up among his fellow-workers, or that the heavy demands of war work in our district cause us to work at high speed and overtime. Let us do it with a glad heart as part of our effort to help our fellow members.

THE TECHNICAL PRESS AND THE JUNIORS.

It is very complimentary to the Juniors that the Technical Press of our industry devote so much of their valuable space to us. Ever since the inception of Junior Associations they have shown a kindly interest in our doings, and encourage us in our effort to attain and maintain the work we set out to do. These journals bring to us every week all kinds of information of an educative kind, ranging from regulating burners to subjects beyond our ken.

THE FUNCTIONS OF THE ASSOCIATION.

I think at this point it would be refreshing to review the functions of our Association. We meet to discuss subjects relating to our work, so as to obtain and give knowledge to one another. Visits are arranged to gas-works, collieries, and manufacturing works allied to our industry, so that we gain an insight as to the extent and importance of the gas industry. We arrange for lectures on various subjects; while we have a circulating library open to all and containing the best books relating to the various departments. By these means we get knowledge and enlightenment on our work, and the various ideas and opinions of the past as well as present experts, and thus prove the advantage of our Association.

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* The proposals here referred to formed the subject of an article in the "Journal" last week, p. 92.—Ed. J.G.L.

Outside the Association we are well acquainted with other ways of extending our knowledge, by means of evening and correspondence classes. But there is another source of learning which is sometimes overlooked, and that is the scene of our daily work. Whether it be in the works, district, or office that we are doing our part, we are carrying into effect, gradually, the designs and plans of our superior. We have him as our teacher, and his management for our experience; while we get acquainted with his ideas, adopt his methods, and all the time gain sound, practical knowledge in a manner which cannot be excelled. When the opportunity occurs that we may become "Senior" and have the full charge of a works, we have confidence in ourselves, a splendid training to start with, while we get the opportunity to put to the test our own ideas and opinions.

The high standard to which the junior must attain, and the training required, make it quite necessary he should obtain a certificate as to his qualifications. The City and Guilds of London Institute is, to my knowledge, the only place at present where examinations in gas manufacture and gas supply are held. These consist of two grades, with two classes in each grade, for each subject. The certificates granted are recognized by the profession, and are undoubtedly a very great help to one.

It has occurred to me that the Junior Associations could assist their members very much in this matter, by bringing before them the full particulars of these examinations, and encourage them to go forward. The members of this Association are not all in the position of being able to attend classes dealing directly with our work; and it appears to me that our meetings and visits could be arranged to assist more directly towards these examinations. Our session's work would be put to the test; while our library would be playing its proper part among members. I sometimes think that we Juniors are inclined to be a little forgetful of the greatness of the industry which we are training for as our life-work. It may be that we know it so well in our own way that we are quite confident of it; while we look on it as a public necessity for supplying light, heat, and power.

THE GAS INDUSTRY IN WAR TIME.

This view, whether it be right or wrong, gave me the idea to put before you a short *résumé* of our "Industry in War-Time." With the outbreak of war came a serious shortage of coals, through interrupted traffic caused by military requirements; and the manner in which gas-works were able to keep up a supply of gas under the circumstances is a page of our industry's history which will always be read with pride. At the same time many gas-works suffered by employees joining the forces; and in this our industry has played its part. The Past-President of the North British Association intimated that 1400 gas-works employees from Scotland, out of a total of 7000, had joined.

Most of us will have had some experience of the way in which gas is being utilized by military authorities and Government contractors; and I believe records are being broken in our zeal to make use of the opportunity afforded, to show that gas is the thing—the three in one, unequalled for light, heat, and power. When we hear of orders for 1000 lights for soldiers' huts in some districts, batteries of cookers, boilers, water-heaters, steamers, and all manner of cooking and heating appliances in other districts, we learn that the authorities find gas suited to their wants and efficient in its work.

Then, again, the extra demands made upon hospitals, public institutions, schools, halls, and billets, has necessitated an extension of cooking and heating appliances, including hot-water supply; while for concentration and military camps, &c., gas is used wherever it is available.

Having referred to the use of gas for the various processes of munition manufacture, as well as for hardening and tempering the tools in connection therewith, the President proceeded:

The application of gas for power purposes is also finding scope among the small traders who have been left short-handed of men, or the trader who has found the war creating extra work for him. The easy and simple way of fitting in present-day gas-engines, and their reliability in working, along with their cleanliness and ease of starting-up, has put a demand on them.

RESIDUALS.

Turning, now, to our residuals, we find that coke is in great demand; and in iron works, steel works, and foundries throughout the country it is used extensively in various departments, also for the making of carburetted water gas for gaseous fuel.

We now have a look into our tar and liquor storage tank, and in this we have the most interesting liquids known. Tar is playing a wonderful part, containing as it does the elements of the most powerful destructive agent, and also the most effective antiseptics known. It is also the source of the famous aniline dyes; while it occupies a prominent place in the chemist's shop. It is the most interesting bye-product in our business, when one considers it is the source of such a variety of chemicals, ranging from curing headaches to making roadways. In "Newbigging's Handbook" a very interesting table is given showing particulars of substances obtained in the manufacture of coal gas and the working-up of the residuals. The list contains about 290 substances.

Sulphate of ammonia is doing its bit, although possibly in a quieter way. Farmers are urged to increase their crops as much as possible; and in sulphate of ammonia they have a manure or land-food of exceptional value to them.

WAR WORK OF ALLIED INDUSTRIES.

Coming, now, to the allied trader of our industry, we find the steel tube makers and the gas-plant firms engaged very much on armament work; while the gas-stove manufacturers are turning out plant to make munitions and various other necessities. The gas-meter manufacturers are doing their bit, by supplying trench periscopes, dixies, mess-tins, and various parts of the shells, some of which are much more intricate than a gas-meter.

If a visit could be paid to-day to all the works that in ordinary times are manufacturing articles connected with the gas industry, it would be found that the variety of work that was being undertaken in the turning out of munitions is something extraordinary. Every company or firm has endeavoured to devote its machinery and plant to the service of the War Office or Admiralty; and the ingenuity that has been brought to bear in adapting machines and tools for the production of work that they were never intended to turn out reflects the highest credit on all who had to do with the transformation. The multifarious work that is being produced in the factories connected with the gas industry it is not desirable to make known publicly.

I refrain from dealing any further on this subject, because at a later date we will have more freedom to review in fuller detail what our industry's part has been in this terrible struggle. But I trust what little I have said may increase your enthusiasm towards the industry.

Distribution Extensions and Alterations at Markinch.

Mr. J. D. Luck (Markinch), then read a paper, which, with a report of the subsequent discussion, will be found on p. 143.

THE COMPOSITION OF COAL.

In the current issue of the "Journal of the Chemical Society" is a paper by Messrs. D. T. Jones and R. V. Wheeler, giving an account of their further studies on the composition of coal. From their previous researches [see "Journal," Vol. CXXVIII., p. 294] on the distillation of coal in a vacuum at low temperatures, they concluded that the "resinous substances" only of the coal conglomerate had suffered decomposition. They have now distilled separately in a vacuum the several portions into which coal can be divided by the solvent action of pyridine and chloroform, and find that whereas the main bulk of the liquid distillates from coal as a whole undoubtedly arises from decomposition of the "resinous substances," the "humic substances" also yield liquid products—a small proportion only, but of destructive character.

The present research also confirms the statement previously made, that the portion of coal insoluble in pyridine and the portion soluble in pyridine but insoluble in chloroform, both consist mainly of the humic class of compounds; while the portion soluble both in pyridine and chloroform is almost entirely of the resinous character. The humus substances yield as liquids mainly phenols; the resinous substances giving paraffins, olefines, and naphthenes, but no phenols. The suggestion is that the portion of the coal insoluble in pyridine should be regarded as derived from the woody fibre or celluloses of the original coal plants; and in confirmation of this it has previously been shown that cellulose yields phenol on distillation. The coal experimented with was an ordinary bituminous one from a Durham mine.

In the distillation of the portion of the coal soluble both in pyridine and chloroform, some of the mass softened at 102° C.; and at 170° C. gases were evolved. At 250° C., considerable quantities of paraffin were distilled over, mixed with some resinous matter. Large quantities of gas were evolved at 320° C. and higher, and had the following composition:

	Per Cent.		Per Cent.
Olefines	0·1	Carbon monoxide	8·4
Carbon dioxide	2·0	Hydrogen	*Nil*
Ethylene	1·9	Paraffins	87·6

The material left in the flask after distillation to 400° C. was a hard compact pitch completely soluble in pyridine. The difference in character between the hard pitch formed from this portion of the coal and the incoherent powders remaining after the portion soluble in pyridine but insoluble in chloroform and insoluble in pyridine clearly demonstrates the fact that the coking properties of coal are due to the resinous constituents. The distillation of the humic substance gave acid water and oil; the latter consisting chiefly of phenols.

As with the resinous material, the gases evolved below 300° C. consisted almost entirely of carbon dioxide and monoxide in the ratio 3:1. The gases evolved between 300° C. and 450° C. showed the following composition:

	Portion Insoluble in Pyridine.	Portion Soluble in Pyridine, but Insoluble in Chloroform.
Olefines	0·4	0·2
Carbon dioxide	3·7	4·4
Ethylene	5·1	5·2
Carbon monoxide	13·6	12·1
Hydrogen	14·8	19·1
Paraffins	62·4	59·0

At the meeting of the Junior Institution of Engineers on Friday next a paper on "Safety Precautions for Transmission Machinery" will be read by W. V. H. Capps.

HEAT TREATMENT OF IRON AND STEEL IN A NEUTRAL ATMOSPHERE.

The Use of Illuminating Gas for the Purpose.

At last month's Detroit meeting of the Michigan Gas Association two papers were presented by Professor Alfred H. White and Mr. Homer T. Hood, the Holder of the Michigan Gas Association Fellowship in Gas Engineering at the University of Michigan. One paper was entitled "Gas as a Case-Hardening Agent;" the second "The Heat Treatment of Iron and Steel in a Neutral Atmosphere." Next week we shall be reproducing the main portions of the former communication. To-day we deal with the second one—depending on a corrected copy of the paper received from Professor White, who is head of the Chemical Engineering Department at the University.

Introduction.

When iron or steel is heated to a high temperature for purposes of forging or heat treatment in a furnace where it comes into direct contact with flames, smoke gases, or other oxidizing atmosphere, its surface becomes first decarburized and then oxidized and covered with scale. Not only is the actual loss of metal in heating for the forge of considerable importance, but surface decarburization is becoming of greater importance in view of the high standards demanded by tool manufacturers and the automobile industry. Mr. J. G. Ayres, jun., in a recent paper ["Proceedings of the American Society for Testing Materials"] has shown that the surface of metal as received from the rolling mill may show decarburization to a depth of about 0·015 inch, and that metal to this depth must be removed from the surface to eliminate all trace of decarburization. He states that decarburization due to heat treatment at lower temperatures is evident though not so serious. It is possible to avoid these undesirable changes by heating the metal in an externally-fired muffle filled with an inert gas such as nitrogen. Externally fired muffles, however, always show a low thermal efficiency, and there are difficulties in the production and utilization of nitrogen. Since heating in illuminating gas alone has been found to cause carburization of steel, while heating in the ordinary products of complete combustion has been found to cause oxidation, it seemed that somewhere between these two extremes should be a composition practically neutral in its effect on steel—that it should be feasible to construct a muffle-furnace with semi-direct firing, in which a mixture of gas with a small amount of air should burn within the muffle to form a neutral atmosphere, and subsequently burn with more air around the muffle, and utilize in this way the full thermal energy of the gas.

Discussion.

Whenever a number of substances are allowed to react with each other for a sufficiently long time, they finally come to a definite stable condition called equilibrium. This equilibrium will vary with the temperature, pressure, and concentration of the substances present. A full solution of the problem here presented would call for a study of the equilibrium between the various possible compounds formed by the interaction of iron, carbon, hydrogen, and oxygen. Such a complete solution, however, would demand a prohibitive amount of experimental work. For practical purposes, it is not absolutely necessary that the atmosphere be strictly neutral; for the rate of reaction decreases as equilibrium is approached, so that there will not be serious change in the surface of the metal if the time of heating be short, even though there is a tendency toward a reaction in one direction or the other.

Although the equilibrium in the complicated system (iron, carbon, hydrogen, oxygen) has not been worked out, the simpler system (iron, carbon, oxygen) has been studied by several authors, and is summarized by Arndt ["Technische Anwendungen der physikalischen Chem."]. From his figures it may be seen how great an influence is exerted by temperature. At 1100° Fahr., iron will not be oxidized by a gas which carries 75 parts of CO_2 to 25 parts of CO, while at 1400° Fahr. not more than 15 parts of CO_2 can be allowed to 85 parts of CO if oxidization is to be avoided. The figures have not been worked out for the higher temperatures; but it is evident that still smaller proportions of carbon dioxide—the oxidizing gas—must be maintained if oxidization is to be avoided at high temperatures. These considerations make it evident that it will be difficult to use producer gas for the production of a neutral atmosphere at high temperatures, since its active constituent, CO, is almost necessarily associated with several per cent. of CO_2 as it leaves the producer, and any attempt to obtain a partial combustion in the presence of the steel would necessarily produce an oxidizing atmosphere.

Preference for Illuminating Gas.

Illuminating gas presents better possibilities than producer gas, on account of the high percentage of hydrogen and hydrocarbons, which act as reducing agents. But in the flame from illuminating gas there will be present not only carbon dioxide as an oxidizing agent but also steam; and if oxidization of the metal is to be avoided the sum of these oxidizing gases must be kept low. A mixture of illuminating gas and air which contains less than 80 per cent. of air is no longer explosive, and will not support combustion unless it receives heat from some external source. This condition is approximately realized in the ordinary bunsen flame. Arndt, in his summary of the work of various authors, gives the average composition of the inner bunsen flame to be:

Reducing Gases.	Per Cent.	*Oxidizing Gases.*	Per Cent.	*Inert Gases.*	Per Cent.
CO	2·2	CO_2	7·2	N	66·6
H_2	2·8	H_2O	20·2		
CH_4	1·0				
	6·0		27·4		66·6

The oxidizing gases in the inner cone are, therefore, four-and-a-half times as great as the reducing gases; and the mixture must exert a strongly oxidizing action on steels at high temperatures. If the amount of carbon dioxide and water vapour is to be kept so low as not to give an oxidizing flame, there will not be enough air in the mixture to support combustion under ordinary conditions. A part of the problem is, therefore, to design a furnace which will give high temperatures and yet burn a very rich mixture of gas and air.

Attainment of High Temperatures in a Neutral Atmosphere.

In ordinary complete combustion of gases, the final products of combustion are CO_2 and H_2O. In the method here proposed, the combustion within the muffle will be very incomplete; and it is desirable to know what temperature it is possible to attain in these circumstances. In order to calculate the theoretical combustion temperature, it is necessary to calculate the volume of the several products of combustion and the amount of heat evolved in the combustion. The gas available was an unenriched coal gas with an average heating value of somewhat over 600 B.Th.U. per cubic foot; and it was found possible to burn this in the furnace described later with two volumes of air. The calculations for the volume of the products of combustion and the theoretical flame temperature are shown in Tables I. and II. The volume of the products of combustion is calculated in two ways which check closely. The simplest method is to work from the percentages of nitrogen; and by this method the volume of combustion gases from 1 cubic foot of gas and 2 cubic feet of air is calculated from Table I. as

$$\frac{12{\cdot}5 + 153{\cdot}4}{52{\cdot}6} = 3{\cdot}16 \text{ cubic feet.}$$

The calculation based on the hydrogen contained in the incoming and outgoing gases is

$$\frac{120{\cdot}2 + 6{\cdot}0}{39{\cdot}7} = 3{\cdot}18 \text{ cubic feet.}$$

The average of these two figures, or 3·17 cubic feet, is, therefore, taken as the volume of the products of combustion of 1 cubic foot of gas with 2 cubic feet of air. Applying this figure to the values for carbon in the gas, as given in Table III., and multiplying the 18·7 volumes of carbon in the combustion gas by 3·17, the figure 59·2 is obtained as that which should correspond to the carbon (calculated as gas) in 100 volumes of the inflowing gas. The actual figure for the inflowing gas is 60·6, which is 1·4 volumes greater than the amount found in the combustion gases. This corresponds to the free carbon which produced a slightly luminous flame within the retort.

Table I.—*Volume of Products of Combustion Obtained from 1 Cubic Foot of Gas and 2 Cubic Feet of Air.*

	Percentage Composition of		
Constituent.	Gas.	Air.	Products of Combustion.
H_2O vapour	3·0	3·0	15·6
CO_2	1·8	—	2·5
Illuminants (C_4H_6)	4·7	—	0·9
O_2	1·1	20·3	0·0
CO	6·9	—	9·8
CH_4	33·1	—	2·8
H_2	36·9	—	15·8
N_2	12·5	76 7	52·6
Total	100·0	100·0	100·0

Constituent.	Total Vol. H_2 Entering into			Total Vol. N_2 Entering into			Total Vol. C. Entering into	
	100 Vols. Gas.	200 Vols. Air.	100 Vols. Comb. Gas.	100 Vols. Gas.	200 Vols. Air.	100 Vols. Comb Gas.	100 Vols. Gas.	100 Vols. Comb. Gas.
H_2O	3·0	6·0	15·6	—	—	—	—	—
CO_2	—	—	—	—	—	—	1·8	2·5
Illuminants (C_4H_6)	14·1	—	2·7	—	—	—	18·8	3·6
CO	—	—	—	—	—	—	6·9	9·8
CH_4	66·2	—	5·6	—	—	—	33·1	2·8
H_2	36 9	—	15·8	—	—	—	—	—
N_2	—	—	—	12·5	153·4	52·6	—	—
Total	120·2	6·0	39·7	12·5	153·4	52·6	60·6	18·7

TABLE II.—*Theoretical Flame Temperature Obtained from 1 Volume of Gas and 2 Volumes of Air.*

(Net Heating Value of 1 Cubic Foot Illuminating Gas Burned Completely.)

Constituents of Gas.	Net Heating Value B.Th.U. per Cubic Foot.	Percentage in Gas.	Net Heating Value, B.Th.U.
Illuminants . . .	2600	4·7	122·0
CO	326	6·9	22·5
H_2	275	36·9	103·0
CH_4	900	33·1	300·0
Net heating value per cubic foot (B.Th.U.) . .			547·5

(Net Heating Value of 3·17 Cubic Feet of Gases Produced by Burning 1 Volume of Gas and 2 Volumes of Air.)

Constituents of Gas.	Net Heating Value B.Th.U. per Cubic Foot.	Percentage in Gas.	Net Heating Value, B.Th.U.
Illuminants . . .	2600	0·9	23·4
CO	326	9·8	32·0
H_2	275	15·8	43·4
CH_4	900	2·8	25·2
Net heating value per cubic foot (B.Th.U.) . .			124·0

Net heating value from 3·17 cubic feet (B.Th.U.)	393
Solid carbon in 3·17 cubic feet = 0·0005 lb.	7
(B.Th.U.)	400

Net heating value of gas on complete combustion .	547	B.Th.U.
Net heating value of products of incomplete combustion	400	
Heat liberated during incomplete combustion . .	147	B.Th.U.

Maximum Theoretical Temperature of Products of Combustion.

Constituents.	Volume in cubic feet.	Mean Specific Heat per cubic foot Interval 60°-2200° Fahr.	Heat Absorbed for 1° Fahr. Rise in Temperature.
H_2O	0·156	0·0245	0·0038
CO_2	0·025	0·0302	0·0007
$CO\text{-}H_2\text{-}N_2$ . .	0·782	0·0189	0·0148
CH_4-Illum. .	0·037	0·0540	0·0020
		(B.Th.U.) . . .	0·0213

Heat Absorbed by 3·17 cubic feet for a Rise in Temperature of 1° Fahr.
= 3·17 × 0·0213 = 0·0675 B.Th.U.

Heat Available		147·0 B.Th.U.
Theoretical Combustion Temperature above Room Temperature . . .	$\frac{147}{0{\cdot}0676} =$	2180° Fahr.
Assume Room Temperature to be 70° Fahr. .		70° ,,
Theoretical Combustion Temperature . . .		2250° Fahr.

The net heating value of the gas is used in these calculations for temperature, since the water formed will escape from the furnace in the form of steam. The specific heats used are the mean specific heats per cubic foot for the range up to 2200° Fahr. The theoretical combustion temperature which can be attained when 1 cubic foot of cold gas is burned with 2 cubic feet of cold air is 2250° Fahr., as is shown in Table II. Still higher temperatures would be theoretically possible if the gases of incomplete combustion could be completely burned in a secondary operation and made to give up their heat to the incoming air.

The laboratory furnace as finally developed is shown in the illustration. The heating chamber is formed from a quartz tube into whose lower end is luted a Méker burner with connections by which both the air and gas supply can be metered. The rich gas mixture became heated as it rose through the hot quartz tube and ignited near the walls soon after reaching the hot zone. The heat of this initial combustion quickly ignited the remainder of the gas, so that by the time the mixture had risen half way in the tube combustion was complete, and the upper half of the tube was entirely free from flame. The pieces of metal were heated in these hot gases of controlled composition. As the gases passed out of the quartz tube, and turned to descend the annular space, more air was mixed with them, and the combustion completed as they passed down around the outside of the muffle. By this method the muffle was kept hot, and loss by radiation was prevented; and the rich gas mixture was brought to the kindling temperature very quickly by means of radiant heat from the muffle, so that a mixture which would not burn in an open flame could be burned easily. When burning a mixture of only two parts of air to one part of gas, a temperature of 2200° Fahr. could be easily maintained within the muffle.

The thermal efficiency of the furnace operated in this manner is indicated in Table IV, from which the following figures are taken:

Net Heating Value of Gas on Complete Combustion, 547 B.Th.U.

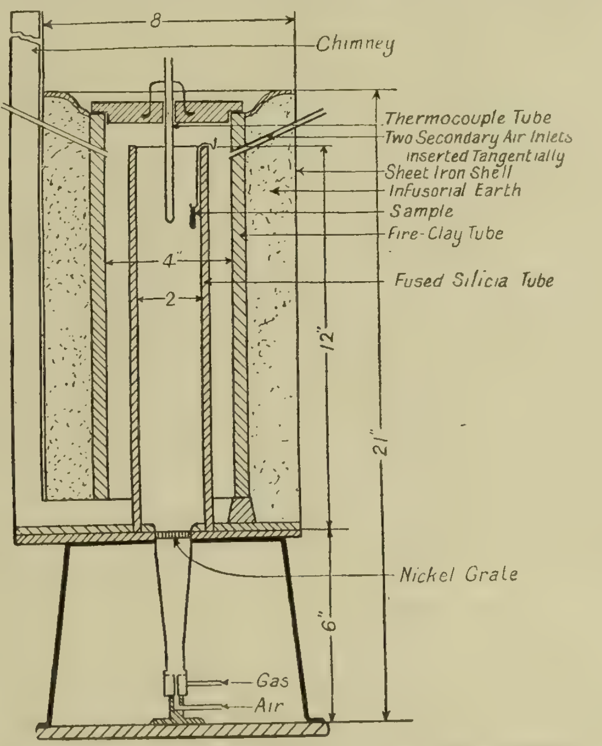
Net Heating Value of Products of Incomplete Combustion, 400 B.Th.U.

Heat Liberated during Incomplete Combustion, 147 B.Th.U.

Thus 147 out of the possible 547 heat units, or 27 per cent., were liberated in the primary combustion around the metal; and the remaining 73 per cent. were liberated in the secondary combustion around the muffle. No attempt was made on this small furnace to utilize the heat of the stack gases to preheat the primary air; but this might well be done in a large furnace with greater thermal efficiency and higher temperature during primary combustion. It would also be possible in this way to burn richer mixtures of gas and air than was possible with the small furnace.

In order to sample the gas within the muffle, it was necessary to cool the gases very rapidly, so as to avoid change in composition. A capillary quartz tube, with its upper part water-jacketed, was inserted through the hole in the cover to sample the gases. In this way there was a temperature drop of about 1830° Fahr. in one inch. From the capillary tube the gas was passed through a weighed calcium chloride drying-tube to absorb the water vapour, and then into a 2-litre gasholder, from which samples were taken for analysis by the usual methods.

Since the rapidity of oxidation is a function of the extent of surface of the metal, and it was desired to get as positive results as possible, the metal to be tested was used in the form of very fine wire. A piece of No. 34 soft iron wire (0·005 inch diameter), about 10 feet long, was wound into a small spiral and weighed. It was then hung on a hook of heavy wire and suspended in the upper part of the central tube of the furnace in the gases which had come to equilibrium in the lower part of the tube. This coil of wire was usually left in the hot furnace for an hour—an excessively severe test for such fine wire. Special precautions had to be taken in removing the hot wire from the furnace, as, if removed while hot, it would have become badly ozidized in the few seconds' exposure to the air. In order to cool it before taking out, a small piece of gas-pipe, with one end closed, was lowered into the furnace on a wire and the sample was placed inside. Here it was at once cooled by radiation to the cold walls of the pipe; and the pipe was removed before it had time to get hot. It is probable that even this method allowed slight oxidation, as a little air would be left in the pipe when the wire was put into it. After removing from the furnace, the sample was weighed and a colorimetric determination for carbon was made after the method outlined by Campbell and Haskins. ["Journal of the Iron and Steel Institute," 1913, II., p. 378.] The increase in weight represented the amount of oxygen absorbed to form magnetic oxide (Fe_3O_4). This oxide contains 2·61 parts of iron for each part of oxygen; so that an increase in weight of 1 per cent. means that 2·6 per cent. of the iron has been oxidized. This wire was very nearly 0·005 inch in diameter, and 1 lb. of it had a surface of about 20 square feet. If 25 per cent. of it were oxidized, the depth of penetration of the oxidation would be only 0·00035 inch and a 2 per cent. increase in weight (equivalent to 5·22 per cent. oxidation) would mean a depth of oxidation of only 0·00005 inch. So it is readily seen that a very slight thickness of oxide is easily measured. Since this wire contained initially only 0·04 per cent. of carbon, an analysis of the treated wire for carbon did not show the decarburization very accurately; so further tests were made on steel piano wire. The smallest size of steel wire at hand was No. 28, which is 0·014 inch in diameter. The colorimetric test showed about 1·25 per cent. of carbon before heating, but practically no carbon after heating for an hour at a temperature of 2100° to 2200° Fahr. Under these circumstances a 1 per cent. gain in weight meant a 2 per cent. gain in oxygen, since the wire lost about 1 per cent. of carbon during the heating process. This 2 per cent. increase in oxygen meant 5·2 per cent. oxidation, and corresponded to a depth of oxidation of 0·00175 inch. If the piece did not change in weight but 1 per cent. of the carbon was lost



Furnace Used for Studying the Action of Gas-Flames on Steel.

TABLE III.—*Extent of Oxidation of Fine Iron and Steel Wires when Heated to 2200° Fahr. in Nearly Neutral Atmospheres.*

Test Number.	Weight of Wire in Grams.		Per Cent. Increase in Weight.	Calculated per Cent. of Fe Changed to Fe_3O_4.	Calculated Depth of Scale in Inches.	Ratio Air-Gas.	Mean Temperature ° Fahr.	Time of Heating.	Colour of Flame at Top of Muffle.
	Before.	After.							
A—Tests with Iron Wire 0·005 inch Diameter and Containing 0·04 per Cent. Carbon.									
3	0·3075	0·4200	36·5	95 5	0·002	2·5	2228	1 hr.	Colourless flame
4 . . .	0·3060	0·3645	19·1	50 0	0·00073	2·43	2100	35 min.	,, ,,
10	0·3010	0 3655	21·4	56·0	0·00084	2·40	2080	1 hr.	,, ,,
5	0·3050	0·3520	15·4	40 3	0·00057	2·25	2100	1 hr.	,, ,,
11	0·2995	0·3350	11·8	30 9	0·00043	2·20	2090	1 hr. 15 min.	Slightly coloured
8	0·3060	0·3320	8·5	22 3	0·00029	2·16	2170	2 hrs.	,, ,,
7	0·3045	0·3105	2·0	5·23	0·00005	2·08	2170	2 hrs.	,, ,,
6	0·3175	0·3185	0·3	0·78	0·00001	1·98	2135	45 min.	Yellow flame
9	0·3136	0·3073	1·2	3·14	0·00004	1·87	2220	1 hr.	,, ,,
12	0·2997	0·3007	0·3	0·78	0·00001	1·86	2100	1 hr.	,, ,,
B—Tests with Steel Wire 0·014 inch Diameter and Containing 1·25 per Cent. Carbon.									
14	0·2935	0·3017	2 79	10·60	0 00038	2·40	2080	1 hr.	Colourless flame
15	0 2995	0·3035	1·33	6·76	0 00029	2·20	2090	1 hr.	Slightly coloured
13	0·3745	0·3743	0·0	3·28	0·00012	1·87	2220	1 hr.	Yellow flame
16	0·3073	0·3065	− 0·26	2·60	0 0001	1 86	2100	1 hr.	,, ,,

and replaced by 1 per cent. of oxygen, then the depth of oxidation would be 0·0008 inch.

EFFECT OF HEATING MILD STEEL IN A NEUTRAL ATMOSPHERE.

Data regarding tests on the fine iron wire with 0·04 per cent. carbon are given in Tables III. and IV. It will be noted that the tests are excessively severe; the fine iron wire being directly exposed to the gases at temperatures of 2100° to 2200° Fahr. for thirty-five minutes to two hours. The figures in Table III. are arranged according to the volumes of air used for one volume of illuminating gas. With 2·5 volumes of air to 1 volume of gas the fine iron wire is, after an hour's heating, converted almost completely into oxide, and with 2·4 volumes of air the oxidation, as shown by the increase in weight, amounts to 56 per cent. [Experiment No. 10]. However, with this fine wire, even this high oxidation gives a film of oxide only 0·0008 inch in thickness—a thickness totally negligible in any ordinary work. The composition of the gases surrounding the wire while being heated is shown in Table IV. The oxidizing agents—consisting of carbon dioxide, steam, and a trace of oxygen—amount in Test No. 10 to 18·3 per cent., and the reducing agents—consisting of carbon monoxide and hydrogen with a small percentage of methane—amount to 27·8 per cent. The ratio of the reducing gas to the oxidizing gases is 1·52.

TABLE IV.—*Gas Analyses.*

——	Average for Illuminating Gas Used.	Composition of Gases After Partial Combustion.				
Test No. . .		5	6	7	10	12
H_2O (yapour) .	3·1	14·6	15·6	14·7	15·5	13·9
CO_2	1·8	3·2	2 5	2·8	2·6	2·0
Illuminants . .	4·7	0	1·0	·6	·0	·9
O_2	1·0	·0	·0	·2	·2	·2
CO	6·9	12·3	10·8	12·7	13·1	10·6
CH_4	31·1	·9	2·4	1·2	2·8	2·9
H_2	36·9	12·5	17·6	19·4	12·9	17·5
N_2	12·5	56·5	50·1	48·4	52·9	52·0
Temperature		2100° F.	2135° F.	2170° F.	2080° F.	2100° F.
Ratio $\frac{\text{Air}}{\text{Gas}}$		2·25	1·98	1·90	2 40	1·85
Sum oxidizing agents, CO_2, H_2O, O_2		17·8	18·1	17·7	18·3	16·1
Sum reducing agents, H_2, CO, illuminants, CH_4 . . .		25·7	31·8	33·9	27·8	31·9
Ratio $\frac{\text{Reducing agents}}{\text{Oxidizing agents}}$ . .		1·45	1·76	1·91	1·52	1·98

With slightly richer gas mixtures, the oxidation (even as shown by the sensitive test of increase in weight) becomes very small. When less than two volumes of air were mixed with one volume of this gas, the flame in the inner muffle became distinctly yellow. This seemed to be a fairly good indication that oxidizing conditions had disappeared, for the three samples of wire (Examples Nos. 6, 9, and 12), heated under these conditions, showed almost no increase in weight and no brittleness on bending, and retained their silvery metallic lustre. The analysis of the gases from the muffle showed the ratio of reducing to oxidizing gases in these tests to be from 1·76 : 1·98.

It was stated in the earlier part of the paper that the work on carbon monoxide had shown that, in order to prevent oxidation of iron, it was necessary to have more than five times as much CO as CO_2 present. With the products from the incomplete combustion of illuminating gas which contain small amounts of hydrocarbons and material amounts of hydrogen, conditions seem much more favourable.

EFFECT OF HEATING HIGH CARBON STEEL IN A NEUTRAL ATMOSPHERE.

The steel wire used in these tests contained 1·25 per cent. carbon, and was 0·014 inch in diameter. When heated to 2000° to 2200° Fahr. for one hour, under conditions similar to those used for the soft iron wire, it was found that oxidation of the metal could be prevented as with the soft iron wire, but that decarburization could not be prevented. In every experiment at these high temperatures, practically all the carbon was removed from the metal. This would mean that the decarburization after one hour at this temperature had progressed at least 0·007 inch from the surface. This is not altogether unexpected, since hydrogen (as well as carbon dioxide and steam) acts as a decarburizing agent. The rate of decarburizing would certainly be slower in this gas than in ordinary furnace operation; and, by the use of still smaller amounts of air, decarburization might be altogether prevented, since case-hardening may be produced when pure illuminating gas is used. There should be no difficulty in preventing decarburization at the lower temperatures used in the heat treatment of steel. The details of these tests on steel wire are given in Part "B" of Table III.

SUMMARY.

It has been shown that it is entirely possible to heat pieces of iron and steel, even to a forging temperature, in an internally fired muffle without any oxidation or formation of scale on the surface of the metal. A neutral atmosphere of this type is produced when approximately one volume of illuminating gas is made to combine with two volumes of air. This mixture is so rich that it will not burn unless preheated. This atmosphere, although neutral to iron, decarburizes steel slowly at forging temperatures. It acts as a much less active decarburizing agent at this temperature than the ordinary furnace atmosphere, and may be rendered less active by using a mixture still richer in gas. At the lower temperatures employed in heat treatment, gas of this composition would cease to exert a decarburizing action.

It should be entirely feasible to make a commercial application of this process. The heat evolved by the primary combustion within the muffle is about 27 per cent. of the possible total heat, and is sufficient to give a theoretical combustion temperature of 2200° Fahr. when starting with cold gas and cold air. A secondary combustion around the muffle aids in keeping up the temperature, so that there is no trouble in actually realizing the temperature of 2200° in a muffle. This secondary combustion liberates all the heat units in the gas, and so raises the thermal efficiency. If the sensible heat of the waste gases should be used to preheat the entering air, a high efficiency could be obtained. When starting with a cold furnace, the full amount of air for complete combustion could be introduced into the gas burning within the empty muffle, which could thus be quickly and efficiently brought to a working temperature. The primary-air supply could then be reduced to the desired amount, and the metal introduced into the muffle where—being directly exposed to the neutral gases—it would be more rapidly heated than in an externally heated muffle, and would still be protected from oxidation. The saving in metal should be considerable, and would probably compensate for any increase in the cost of fuel. The process presents attractive possibilities in its application to the automobile industry and other industries where quality is paramount.

DEVELOPMENTS IN THE DOHERTY WASHER-COOLER AS A GAS-CONDENSER AT DETROIT.

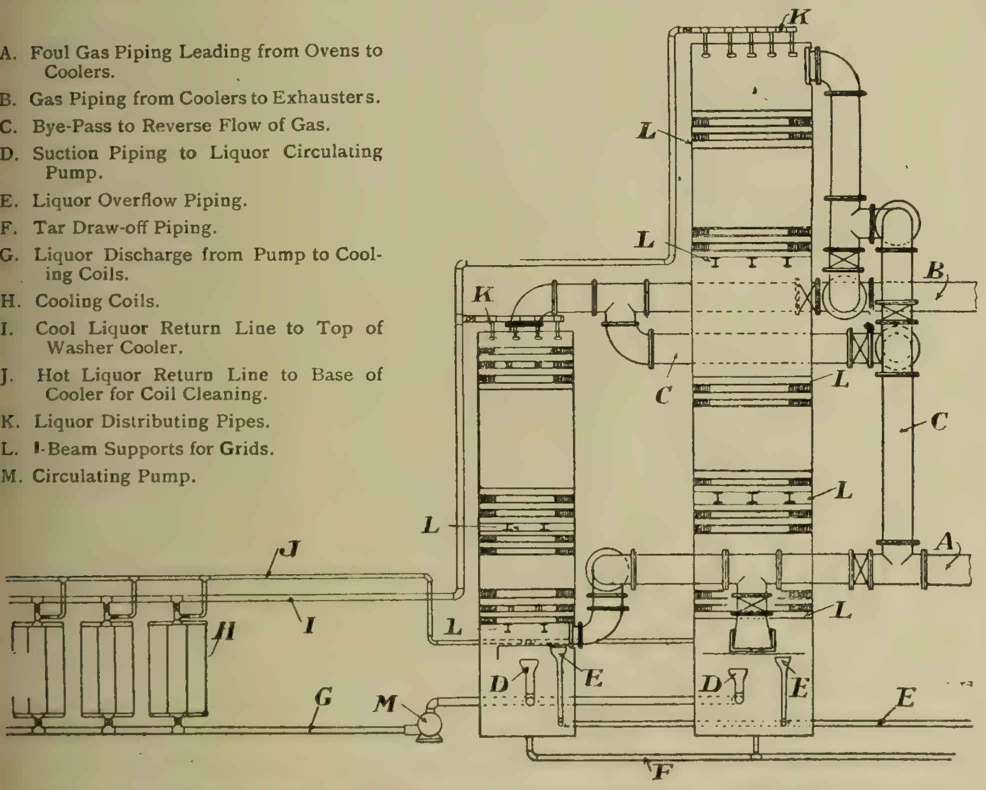
By Robert B. Rowley.

[A Paper read before the Michigan Gas Association, Sept. 23.]

In 1907, Mr. W. Seymour favoured this Association with a paper entitled "A New Method of Condensing and Scrubbing," in which he described the first installation of a Doherty patent washer-cooler as a coal-gas condenser at Grand Rapids. Briefly, this type of apparatus consists of a device whereby the crude gas is brought into direct contact with a supply of cooling liquor, which cools the gas and at the same time washes out mechanically those substances which are separated during the cooling. The liquor is then cooled in coils, and returned to the gas compartment for further use.

The installation referred to consisted of an apparatus divided into eight compartments, through which the gas passed alternately up and down. This resulted in a parallel current of gas and liquor in four compartments and a counter-current flow in the other four. Each compartment was equipped with a circulating pump and a set of cooling coils; and a separate liquor circulation was maintained in each.

Four years later, Mr. L. E. Worthing presented to the American Gas Institute a paper entitled "Some Principles of Condensation with Especial Reference to Water Gas." In this paper he gave a description of a washer-cooler which was being used by the Detroit City Gas Company as a water-gas condenser. This apparatus consisted of a three-compartment unit in which the gas passed upward in each compartment, making a counter-current flow of the gas and liquor throughout. A separate pump and a separate circulation were also used on each compartment with this water-cooler. With this installation, the cooling was reduced to triple stage.



A. Foul Gas Piping Leading from Ovens to Coolers.
B. Gas Piping from Coolers to Exhausters.
C. Bye-Pass to Reverse Flow of Gas.
D. Suction Piping to Liquor Circulating Pump.
E. Liquor Overflow Piping.
F. Tar Draw-off Piping.
G. Liquor Discharge from Pump to Cooling Coils.
H. Cooling Coils.
I. Cool Liquor Return Line to Top of Washer Cooler.
J. Hot Liquor Return Line to Base of Cooler for Coil Cleaning.
K. Liquor Distributing Pipes.
L. I-Beam Supports for Grids.
M. Circulating Pump.

General Arrangement of the Lean-Gas Condensing System (Semet-Solvay Company) at Detroit.

In 1910, Mr. W. S. Blauvelt presented a paper to this Association, in which he described an installation of washer-coolers used as coal-gas condensers at the Detroit plant of the Semet-Solvay Company, which Company hold the rights for this type of apparatus in the coke-oven field. These washer-coolers were put in operation about the same time as the three-stage apparatus installed by the Detroit City Gas Company, and were intended to operate in two stages—that is, the cooling was done partly in a primary cooler and completed in a secondary unit. The installation required only two circulating pumps and two separate liquor circulations; and the cooling was reduced to double stage.

In the few years since the installation of the first Doherty washer-cooler at Grand Rapids until the adoption of two-stage cooling by the Semet-Solvay Company at Detroit, the system had been reduced from an apparatus cooling in eight stages to a system using only two. Since 1910, the capacity of the Detroit plant of the Semet-Solvay Company has been increased, by steps, from 1200 tons to 2400 tons of coal daily. In order to increase the capacity of our condensers, and to better handle apparatus cleaning arising from this increase in output, the two-stage system has gone through a further simplification, and has been remodelled into a single-stage system, in which all the cooling of the gas is performed in one operation in a single unit. It is the purpose of this paper to show some of the reasons why this change was made, and to give a brief outline of our condensing system and its operation as it now exists.

At the Detroit plant, the gas coming from the ovens during the first part of the coking period [rich gas] is kept separate from that evolved during the latter part of the coking [lean gas], which is used for fuel at the plant. This makes necessary the installation of independent cooling and scrubbing apparatus for the rich and the lean gas. With normal operation both the rich and lean gas leave the hydraulic main practically saturated with water vapour. As the operation is on a very large scale, the effect upon the total gas output of fluctuations caused by charging and discharging one oven is very trifling; and the temperature of the gas entering the coolers varies but slightly from day to day, and only a few degrees from season to season. For this reason, it is possible to determine accurately the amount of heat that must be removed for a definite quantity of gas entering the washer-cooler at any given temperature.

With the washer-cooler and the direct contact method of cooling, using the counter-current flow, a maximum heat transfer is obtained by bringing the temperature of the gas leaving the top of the cooler to the temperature of the cooling liquor entering, and by bringing the temperature of the liquor leaving at the bottom of the apparatus as closely to the temperature of the gas entering as is possible, without endangering the positiveness of the cooling in case of an increase in the output.

When operating a washer-cooler in this way, it is only necessary to supply a volume of cooling liquor capable of absorbing the heat of vaporization of the condensable vapours carried by the gas, which from a thermal standpoint consist chiefly of water vapour, and to cool the gas itself. Since the condensate and circulating liquor leave the bottom of the cooler almost at the temperature of the gas entering, little cooling of the condensate is required within the column. Although the condensate which separates near the top is cooled, it is again heated before separating from the gas.

The quantity of heat which it is necessary to abstract per minute to cool from various temperatures one million cubic feet per day of gas saturated with moisture is shown graphically by the author. The gas volume is corrected to 0° C. and 760 mm Hg saturated with moisture. The figures include the quantity of heat it is necessary to abstract from the gas to lower its temperature and the quantity which must be removed in order to condense the water vapour. It does not include, however, the heat removal necessary to lower the temperature of the condensate to the lower temperature, as this is not done in the washer-cooler itself, when operated in the way already described. The heat removal required to condense the hydrocarbon vapours carried by the gas has been neglected, as it is a very small percentage of the total heat.

The figures were calculated from a table of data prepared by Mr. Herbert A. Humphrey, and published by him in the "Proceedings of the Institute of Mechanical Engineers" for 1900. This table gives data covering the characteristics of saturated gases between 0° to 100° C. (32° to 212° Fahr.). The figures have also been checked against the actual practice, and agree very closely with the actual heat removal.

From the curve it is seen that the thermal capacity of gas when saturated with moisture is much greater per degree change of temperature at the higher temperatures, and that the quantity of heat to be removed per degree of cooling becomes greater at a continuously increasing rate as the temperature rises. The author remarks: For our work it is not necessary to consider gas at a temperature above 85° C. (185° Fahr.), although the recent tendency toward faster coking times and higher oven temperatures tends to increase the temperature at which the gas enters the condenser. If the gas enters the cooler saturated with moisture at 85° C. (185° Fahr.), it is seen that 47,000 B.Th.U. must be removed per minute to cool a million cubic feet of gas per day to 0° C. (32° Fahr.) and condense the water vapour. About 43,000 B.Th.U. will be removed, however, when the gas temperature has been lowered to 42·5° C. (108·5° Fahr.), or through half the drop in temperature desired. In other words, 91·5 per cent. of the total heat is removed in cooling the gas to 42·5° C. (108·5° Fahr.) through only 50 per cent. of the temperature drop.

It is also seen that in this system of cooling the capacity of any quantity of liquor for cooling depends almost entirely upon the range of temperature change through which it can be made useful. If heated from 42·5° to 85° C. (108·5° to 185° Fahr.), a certain quantity of liquor can absorb only 50 per cent. as much heat as the same quantity when heated from 0° to 85° C. (32° to 185° Fahr.).

Because of the varying quantity of heat that it is necessary to abstract, in order to cool a certain quantity of gas 1° at the different temperatures throughout the cooling, and because of the very small heat removal necessary at low temperatures, considerably less cooling liquor is required to cool a definite quantity of gas between temperatures of low range than through those of short range, when cooling from the higher temperatures.

A curve was also constructed to show how this feature affects the quantity of cooling liquor required in a washer-cooler to cool gas saturated with moisture to the temperature of the cooling liquor entering the column with the liquor leaving the column at the temperature of the gas entering. These calculations have been made with the assumption that a perfect heat-exchange is obtained in the column and that the maximum cooling capacity of the liquor is utilized. In actual practice this is, of course, not obtained. It is easily possible, however, to keep the temperature of the liquor leaving the cooler within 5° C. (9° Fahr.) of the temperature of the gas entering. When cooling from 82° to 27° C. (147·6° to 48·6° Fahr.) with this difference, the cooling range in the gas extends 55° C. (99° Fahr.), while that of the liquor only 50° C. (90° Fahr.). This reduction of the range through which the liquor is heated causes a correspondingly larger quantity of liquor to be used in practice than is shown on the chart—depending upon how closely the gas can be brought to the temperature of the cooling liquor as the temperature of the liquor leaving is brought closer to the temperature of the gas entering. With the liquor leaving 5° C. (9° Fahr.) below the temperature of the gas entering, under the conditions mentioned above, about 90 per cent. of the maximum cooling capacity of the liquor is being used, and the actual circulation can be calculated from the theoretical by use of this factor.

Reference to another curve shows that a cooling circulation of 64·5 gallons per minute is required to cool a million cubic feet of gas per day measured at 0° C. and 760 mm. from 85° to 40° C. (185° to 104° Fahr.). In this case the cooling liquor would enter the washer-cooler at 40° C. (104° Fahr.) and leave at 85° C. (185° Fahr.), or would be heated through a range of 45° C. (81° Fahr.). If the cooling were to be done between 0° and 85° C. (32° and 185° Fahr.) by liquor entering at 0° C. (32° Fahr.), a circulation of 37 gallons per minute would be sufficient. To cool the same quantity of gas through a range of 85° C. (185 Fahr.) requires only 57·5 per cent. as much liquor as is needed when cooling through a range of 45° C. If this same quantity of gas were cooled from 85° C. (185° Fahr.) to 60° C. (140° Fahr.) by liquor entering at 60° C. (140° Fahr.), a cooling circulation of 85·4 gallons per minute would be necessary.

Let us now consider, the author resumes, the thermal conditions within the cooler itself. The following table shows the quantity and percentage of heat removed per minute from gas saturated with moisture at 85° C. at the rate of a million cubic feet per day measured at 0° C. and 760 mm., when cooled to lower temperatures.

Gas at the Rate of a Million Cubic Feet per Day Measured at 0°C. and 766 mm.

Temperature to which Gas is Cooled from 85° C. (185° Fahr.).		Heat Removed per Minute B.Th.U.	Percentage of Heat 0°C. (32° Fahr.) Removed When Cooled to Lower Temperature.
°C.	°Fahr.		
80	176	15,386	32·6
70	158	30,288	64·2
60	140	37,320	79·1
50	122	41,205	87·5
40	104	43,517	92·3
30	86	44,984	95·4
20	68	45,952	97 5
10	50	46,614	98·9
0	32	47,122	100·0

As the cooling liquor entering at the top descends through the column it becomes heated, and in turn cools the gas which is passing upward through the column. When cooling a fixed quantity of gas between certain temperatures with a definite quantity of liquor, it is a matter of simple calculation to show the change in temperature of the liquor as compared with that of the gas. This has been done for a washer-cooler when operating under various conditions; and the results are plotted in a third diagram.

This shows that at the top of a cooler working with a perfect heat exchange, the temperatures of the gas and liquor are the same. As the liquor flows downward through the apparatus, the thermal difference increases until it reaches a maximum in the part of the apparatus where the gas temperature is from 60° to 70° C. (140° to 158° Fahr.), depending upon what range the cooler is working through. With a washer-cooler between 20° and 85° C. (68° and 185° Fahr.), the difference in temperature between the gas and liquor increases from 0° at the top of the washer-cooler where the temperature of both the gas and liquor is 20° C. (68° Fahr.) to a maximum of 28·5° C. (83° Fahr.) at the part of the column where the gas is 65° C. (149° Fahr.), and then falls to 0° again at the base of the column where the temperature of both the gas and liquor is 85° C. (185° Fahr.).

At the Detroit plant, the average temperature of the gas entering the coolers runs a little over 80° C. (176° Fahr)., and the cooling problem consists in cooling this gas to a temperature varying from 15° C. (59° Fahr.) in the winter to 27° C. (80·5° Fahr.) in summer. As the output increased, it became more and more difficult to properly cool the gas; and after due consideration of the above principles, and more especially to relieve stoppages in the secondary lean condenser and secondary rich and lean cooling coils, it was decided to try single condensation.

Accordingly, the cooling coil installation was changed from the old two-stage system to a new arrangement, which allows a straight passage through double pipe cooling coils, and the liquor cooling to be done in one operation. The cooling coils are double pipe coolers of the same type as those described by Mr. Blauvelt in 1910. In these the cooling liquor flows through the annular space between a 2-inch and 3-inch pipe with water passing both through the inside of the 2-inch and over the surface of the 3-inch pipe.

Since all the cooling has been done in the one washer-cooler, very little liquor or condensate separates from the gas at a low temperature. All the condenser liquor leaves at a temperature above 158° Fahr., and is comparatively clean. Experience has been that the tarry matter and suspended naphthalene separate much more readily from liquor at a high temperature than at a low temperature. Because of the higher temperature at which the liquor separates from the tar in the single-stage system, the liquor going to the cooling coils is much cleaner than it was when coming from the secondary condenser with the two-stage system. This has resulted in much less trouble with naphthalene deposits in the cooling coils.

The washer-coolers used in this service until recently were the old primary coolers described by Mr. Blauvelt in 1910, with an additional 5 feet of gridding. One of these coolers has been used for the lean gas and one for the rich. Since the capacity of the plant has been increased to more than 2000 tons daily, the lean cooler has been overloaded during summer weather, and a new unit has been built to handle the lean gas—the old unit being retained as a spare to be used when the new cooler is being cleaned. This new washer-cooler has been designed to allow a maximum heat absorption by the cooling liquor and to bring the temperature of the gas leaving to the temperature of the liquor entering the column. The general arrangement of the new lean cooling system is shown in the illustration.

This new washer-cooler was only erected during the past summer, and has not been in operation sufficiently long to present any accurate data from its operation. The old coolers as single-stage washers have given very good results when not overloaded, and have verified the conclusions which were reached theoretically from the curves given in the paper.

With single-stage condensation as practised at Detroit, all the tar which is taken from the gas in the condensers is removed from contact with the gas at the highest temperature that exists within the condensing system.

It would also seem that with the new single-stage cooler the condensing process is being conducted in as short a time as present knowledge and equipment will allow. In the "Proceedings" of the Association for 1911 is the following statement by Professor A. H. White and R. S. Tour: "Would the candle power or heating value be injured by rapid cooling? The answer is quite certain that they would not. The more benzol retained in the gas the better. The quicker the tar is removed from the gas, and the higher the temperature at which it is removed, the better will be the candle power and heating value of the gas." The experience to date at the Detroit plant bears out this statement.

Conclusion.

To sum up, the substitution of single-stage for double-stage condensation has allowed the separation of all the condenser tar at a point of highest temperature and in an extremely short time.

It has permitted the elimination of two washer-cooler units from the condensing system, and a corresponding reduction in the pumping equipment of two units. The same pumps which previously provided the primary circulation took care of the single-stage coolers, even with the increased load, until the construction of the new lean washer-cooler with its increased height.

The use of steam has been eliminated as a means of coil and apparatus cleaning—its function now being performed as a matter of routine by the heat and tar carried by the crude material itself.

And, finally, the move has been a simplification, and has resulted in a clearer understanding of, the apparatus and its operation by the operating force, which, in turn, has reacted to give uniform and more satisfactory results.

Heating Water in a Holder to Prevent Freezing.—It was suggested to the Committee on Manufacturing of the Iowa District Gas Association that among the matters to which they should give special attention might be the most economical way to heat the water in a holder in a small plant, to prevent freezing. They accordingly took up the subject, and have reported as follows: The amount of waste heat that is practically a total loss in any water-gas plant is enormous. There is no better way to prevent a holder from freezing than by using some of this waste to heat water, and circulate it from the tank or pit through the heater or condenser back to the cups and tank. In a plant where water gas is not made continuously, it would be necessary to provide steam syphons also. The plan of using the water from the holder-tank for cooling in the water-gas condenser, and at the same time heating the water in the holder-tank, has been tried successfully at the Davenport Gas-Works. When using steam-syphons, care must be taken that they are constructed properly. The idea of using a syphon is to get a good circulating movement in the water.

DISTRIBUTION EXTENSIONS AND ALTERATIONS.

By J. D. Luck, of Markinch.

[A Paper read before the Scottish Junior Gas Association (Eastern District), Oct. 16.]

In his paper, the author dealt with alterations and extensions by his Company during the past sixteen months. He said that on his appointment as Manager of the Markinch Gas Company in the early part of 1914, it was decided to carry out an extension of the mains to the village of Coaltown of Balgonie. In addition to the supplying of this new district, it was found necessary to make certain improvements on the mains in Markinch, owing to insufficient supply. In the main street in Markinch, it was found that there was an insufficient supply for the increasing demands on the main; and he at once saw the urgency of an efficient supply being given before the advent of another lighting season. Though the greatest demand for gas came from the High Street, there was a general complaint of poor supply all over the town. This had to be overcome without further delay, in addition to the extension of the gas supply to Coaltown of Balgonie.

As to the supply for Coaltown of Balgonie—a village three miles from Markinch, consisting of one main street with branch streets off, formed by rows of colliers' houses and a few cottages and shops, with a school and a large hall—it was expected that about three-fourths of the householders would ultimately take gas, this being 165 in number. However, by a personal canvas made later, he was able to bring up this number to nearly 200. In drawing up the estimate for the scheme, however, the number of consumers was put down as 165.

For supplying the village, the question of available pressure was a very serious one, the altitude at Coaltown being practically level with the works; and as they were already faced with an insufficient supply at Markinch, it was absolutely essential to safeguard against want of pressure in the new district. He therefore went into the question of an entire low-pressure scheme, embracing the Markinch supply, and of a combined high and low pressure scheme giving an independent supply to Coaltown of Balgonie. To improve the Markinch supply, it was proposed to take up 300 yards of 6-inch main, running from the works, and substitute a 10-inch one; the 6-inch pipe to be utilized to replace a 2½-inch pipe in the High Street. The estimated costs were entirely in favour of a combined high and low-pressure system for Coaltown of Balgonie, and the substituting of pipes of a larger diameter in Markinch; the estimate for this complete scheme being £1824, as compared with £2157 for the low-pressure scheme.

Now that the scheme was decided on, it was necessary to arrange how the work of laying the main and service pipes should be carried out. Being a small undertaking, they had not, of course, a staff of fitters at hand; and it was decided to contract this part of the work, making the contractor entirely responsible for both the digging of the track and the laying of the pipes. In drawing out the specification, the scheme was divided into three sections. No. 1 section included the taking out of the 6-inch pipe from the holder to the branch-piece, 300 yards up the road, and substituting a 10-inch pipe—the 6-inch pipe to be laid aside and used later. The 4-inch high-pressure main to be laid from the works up to the same point. No. 2 section included the continuing of the high-pressure main along the High Street, to take the place of the existing 2½-inch pipe. No. 3 section included cutting the track and continuing the 3-inch high-pressure main to Coaltown of Balgonie, also laying the low-pressure mains in the village. It was decided to adopt Mannesmann pipes, with rigid or long-sleeve joints; his recommendation of Mannesmann pipes being influenced mainly by his own personal experience of them elsewhere. The long lengths, and consequent saving of joints, were their great advantage. All the jointing on the high-pressure main was to be done with lead wool.

In No. 1 section, two ways were open to execute the work of taking out the 6-inch main and replacing with the 10-inch. The methods were to disconnect at the holder and lay in a temporary pipe 50 yards up, allowing the town to be supplied with gas while the first 50 yards was being connected by the new 10-inch main; or to open up the whole track for 300 yards and connect-up in one day, cutting off the gas supply for the time being. The latter was the plan adopted. Notices were posted up throughout the town, and, in addition, a postcard written to each of the large consumers who were entirely dependent on gas for power, intimating that the supply would be cut off from 7 a.m. till 6 p.m. The day selected was a Wednesday—the local half-holiday. The track was opened for the whole 300 yards, and all the services bared about a yard back from the main, to allow them to be reconnected to the new pipe. There was good weather, and this enabled them to have the whole section completed in one day, and the gas turned on again at the hour promised.

Passing on to No. 2 section, this dealt with the continuing of the 4-inch high-pressure main and the taking out of the old 2½-inch pipe in the High Street, to be substituted by the 6-inch pipe lifted. It would be noticed the high-pressure main again entered the track alongside this 2½-inch pipe. In the course of his preliminary investigations, the idea of boosting-up the mains in Markinch suggested itself to him. This would have saved the necessity of altering any of the Markinch pipes, had it been possible. Circumstances, however, compelled him to abandon such a proposal. He was made aware of the faulty condition of this 2½-inch pipe by systematic piercing, and, on baring it, found it to be in a very bad and leaky condition. The pipe was laid in 1874. It was also found to be lying with only 18 inches of cover, and in some parts less. This meant the deepening of the track for the new pipes, as the amount of cover had to be not less than 24 inches from the top of the pipe—the High Street being usually a busy thoroughfare. On this section there were about 80 services to disconnect from the 2½-inch pipe and re-connect to the 6-inch pipe. To put the consumers to as little inconvenience as possible, they arranged to open-up and disconnect 50 yards daily. As they now had gas coming from both directions of the main—the gas circulating from the street running parallel, and being connected to the High Street pipes at both ends—consumers were only affected on the day their section was disconnected, and then merely for a few hours.

Starting from the branch-piece at the east end of the High Street, 50 yards of pipe were bared, and the track made broad enough for the reception of both pipes. The 2½-inch pipe was cut-out for a distance of 25 yards and laid aside; a temporary plug being put in the end of the 2½-inch main in the track. The fitters had three lengths of 6-inch pipe jointed together, ready with the holes bored and tapped for the service connections. This saved considerable time, and allowed one of the fitters to bore and tap the pipes before lowering into the track. Each forenoon the labourers opened up 50 yards to prepare the way for the fitters the following day. The afternoon work of the labourers consisted of filling-in the track of the finished work done by the fitters. In this way, only 50 yards of track at a time were left open overnight; and no exception could be taken to this distance by the local authorities. This was an important point which had to be considered when operations of the kind were being carried out on a county thoroughfare.

On this stretch of main there were several old 1-inch cast-iron services crossing the road to supply consumers on the other side of the street. As they had in some cases only about 12 inches of cover, it was necessary to improve these. It was not possible to have the services bared all the way at this time, which would have meant blocking the thoroughfare; but these cases he noted, and had replaced by malleable iron later. This enabled them to lower the services all the way, and thereby run no risk of broken services later, as the county authorities were waiting for them to finish their job before they commenced to improve the surface of the roads.

Unfortunately, operations were brought to a standstill for a few days at this stage, owing to a strike at the works of the British Mannesmann Tube Company in South Wales; and later on, at the outbreak of the war, delay was again experienced owing to lack of proper waggons for transporting the pipes. When the pipes arrived, No. 3 section was proceeded with. The 3-inch main joined the 4-inch high-pressure main at the point crossing the railway bridge, and continued to a spot where a 2-inch reducing governor was fixed, controlling the supply to 38 houses. Then it went on to Coaltown of Balgonie; a governor being fixed to control the supply to the village. The high-pressure main being completed, the whole stretch from the works to the village was put under test. The main was subjected to a pressure of 10 lbs. per square inch by means of the compressor erected at the works. The pressure was sealed in the main, and allowed to remain overnight. As was the case with sections Nos. 1 and 2, this section was most satisfactory.

As to the low-pressure mains and services in Coaltown of Balgonie, the 4-inch main ran along the entire length of the village on the north side of the main street, and under the footpath; and they had decided to run a 3-inch pipe along a portion of the south footpath. This enabled them to put in all the services without having to cross the macadamized road. For the services, the Gas Company provided all the malleable iron piping and fittings, which varied from ¾ inch to 1½ inches bore. They also supplied service saddles, stopcocks, and compo. pipe for connection to the meter-inlet. The contractor supplied the labour, tools, tackle, red lead for jointing purposes, holdfasts, and solder for the completion of the work. The malleable iron pipe saddles adopted were found most satisfactory for the Mannesmann tubes. For the fixing of these saddles it was necessary to strip the covering all round the pipe. The main being bored and the service saddle fixed, the connection was carefully wrapped over with the canvas provided for the purpose, and soaked in tar. Each service-pipe was laid with a gradual rise towards the building, and had at least 10 inches of cover. In every case, the shortest route possible was taken, and bends used in preference to knees and elbows. The service-pipes were laid on and carried to a wall-shelf for the meter, previously fixed by the proprietor. These shelves were fixed in the sculleries, at a convenient corner, thus allowing the Company to fix cooking appliances later and ensure a good supply. Where it was possible, one service-pipe was laid of sufficient size to supply two or more attached houses. If it was found necessary to carry the service-pipe across the face of the plastered walls or through partitions, &c., compo. pipe was used, and any damage done to the plaster work made good to the satisfaction of the proprietor.

The smallest services put in were ¾-inch; the stopcocks being ¾ to ½ inch. The ¾-inch female end was fixed to the service-pipe just inside the walls; and to connect to the meter-inlet 2 feet of compo. pipe was required.

With regard to carcasing, the majority of the houses were two or three roomed, with scullery behind. The pipe from the meter was ½-inch compo. past the first branch-off in the kitchen, which was ⅜-inch compo. A ⅜-inch pipe continued off the ½-inch pipe to the rooms. The scullery branch was taken off the ½-inch pipe at the meter. In order to have the pipes exposed as little as possible in the various rooms, they recommended the putting in of a hatchway in every house. In some cases, however, it was possible to utilize a hatch for two houses. The hatchway enabled them to get advantage of the space between the room ceilings and the outside roof. It also enabled the work to be carried out in a more satisfactory manner than exposing all the internal pipes on the face of the wall. The only pipes shown were the lengths between the kitchen and room brackets to the ceiling.

The majority of the consumers in Coaltown of Balgonie use slot-meters, and it was resolved to adopt one maker's meter only; the same padlock being used for every meter. They early found the advantage of this policy. In common with other gas undertakings, they were recently compelled to raise the price of gas. This meant altering the change-wheels on the slot-meters; and it would at once be seen how easy a matter it was to make the necessary change. It was regrettable that so many meter makers had a different pattern of change-wheel. If it were possible to standardize these wheels as well as meter-unions, it would be a great boon to gas undertakings.

So far, the scheme had turned out very successfully. The make for the year ending April 30 showed an increase of fully 2½ million cubic feet, or 28 per cent., over the previous year. The complaint of poor supply from Markinch consumers was a thing of the past; and the new district was well served with an up-to-date and most efficient supply.

Concluding, he said the Markinch scheme, with which he had dealt, cost £2411, being £117 over the estimated outlay—caused through the increased number of consumers.

DISCUSSION.

The PRESIDENT, in thanking the author, said the subject was one of great interest to juniors, because they had to supervise or do such work.

Mr. MOYES congratulated Mr. Luck on the actual cost of his scheme being so near the estimate.

Mr. J. B. SCOTT said he did not know any Scottish district where there was more of this sort of work than Fife. In Fife, villages had sprung up repeatedly in past years, and such jobs cropped up again and again—not only once in a lifetime. Sometimes one talked of high pressure when only meaning from 2 to 2½ lbs.; but high pressure was more than using the booster to pump out the gas. Regarding the tapping of the main, which was very important, in his own district they followed two ways. For some years they had been using the Parkinson and Woodall expanding nipple; latterly they had been trying Mr. Luck's method. Personally, he preferred the expanding nipple, especially in districts where underground workings were troublesome.

The PRESIDENT asked Mr. Luck if, on cutting a steel pipe, he found in the middle of the pipe where he cut, after filing the edge, that he could not get the centre cut piece to enter the faucet.

Mr. LUCK, in reply, said he had no difficulty in this way with the Mannesmann pipe.

The PRESIDENT proposed a hearty vote of thanks to Mr. Luck [which was accorded]; and the proceedings concluded after the members had examined some specimens of pipes and couplings which Mr. Luck explained.

LIMELESS CONCENTRATION OF GAS LIQUOR.

By JOHN S. UNGER, of Chicago, Ill., U.S.A.

[From the "Gas Age," New York, Oct. 1.]

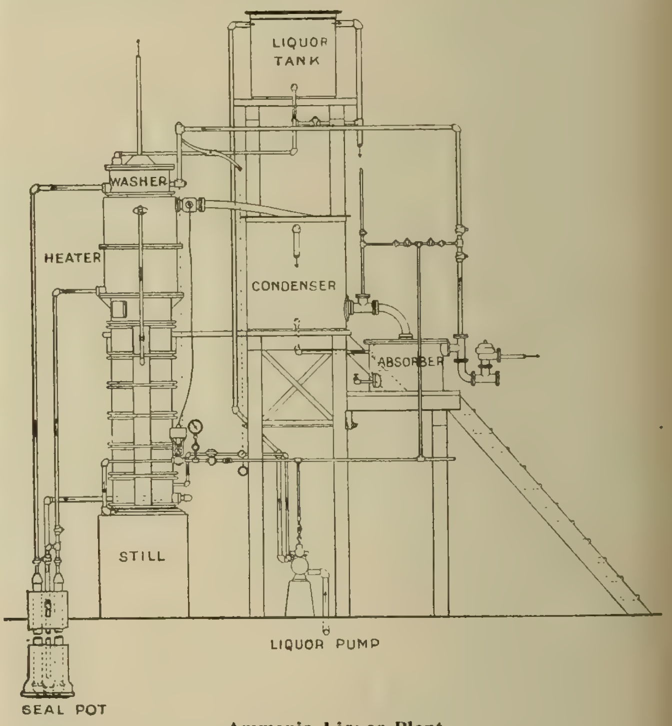
To many managers of small coal-gas works, the question as to whether gas liquor should be saved, and the condensing and scrubbing system so manipulated that it would pay to concentrate the liquor, also whether an ammonia still could be operated with the present labour in attendance at the works, seem beset with so many difficulties that a valuable bye-product is allowed to go to waste, even in works carbonizing as much as 8000 tons of coal per annum. Other gas managers are more courageous, and instal ammonia stills in works with a yearly carbonization record of only 3000 tons. While in some of these works the ammonia still soon ceases to be either ornamental or useful, this article is written in order to encourage the installation of stills in small gas-works for the recovery of only the free ammonia, but so arranged that a lime leg and an additional sections can be added, for the recovery of the total ammonia, when the works grow larger.

Necessarily, the ammonia losses in small gas-works will be high in proportion to the total ammonia in the gas, more especially in warm climates. But, in the more temperate zones, with cool condensing and scrubbing water, these losses can be limited to the ammonia lost by evaporation and the liquor lost in defective joints and pipes. In other words, the works will have to be carefully operated in order to get good ammonia results; and in this respect it is said that small gas-works are at a disadvantage, owing to lack of skilful attendance, and to the multitude of duties devolving upon a small number of men. But, otherwise, smallness should not stand for inferiority. It is just the ammonia recovery which would give an ambitious manager the opportunity to show his ability.

Going into ammonia recovery means a more careful use of water in the hydraulic main and in the scrubber, and a circulation of weak ammoniacal liquor through the first scrubber or washer. This liquor can be supplied from the same pump that feeds the ammonia still. In regard to feeding the second scrubber with cold water, it is necessary to flush the scrubber at time-intervals; otherwise the distribution of the water in the scrubber would be defective. The flushing can be done with an ordinary 5-gallon automatic flushing tank, as used by plumbers.

The amount of fresh water entering the system will determine the strength of the weak liquor. In some works it is the practice to feed cold water into the hydraulic main on the slightest pretext, thereby making an ammonia washer of the hydraulic main and spoiling the liquor; while in other works the hydraulic main performs its function continuously, without any doctoring. The trouble is partly in the management and partly in the method of relieving the main of tar; but the requirements of good main construction are now so well known that it is unnecessary to further dwell on this matter.

By omitting the lime apparatus, the price of the still is greatly reduced, and the attendance confined to the running of the liquor pump and the starting and stopping of the still, provided the steam supply is controlled by a thermostat in the vapour pipe and the apparatus is so constructed that a commercial concentrate can be made without troubles from stoppages and consequent loss of ammonia. The illustration shows such an apparatus. It will be noticed that the weak liquor is preheated in the seal-pot by the heat of the waste liquor; the exhaust steam from the liquor pump is utilized in the still; and the live steam goes to the still controlled by a thermostatic regulator.



Ammonia Liquor Plant.

The still illustrated will make a 20 per cent. concentrate without troubles from salting, by an arrangement on top, called a heater, in which the weak liquor is further heated to about 190° before entering the still proper; and the gases liberated in the heater are washed by the cool liquor passing downward through the washer, so that the ammonia is absorbed, but the gases expelled into the atmosphere. This is very important when lime is not used; otherwise it may become impossible to make a concentrate with more than 13 per cent. of ammonia, without stoppages in the condenser and salt in the storage tank. The concentrate, when made as explained, becomes more valuable to the refiner, because less impurities will have to be removed; and the stronger the concentrate, the less it will cost to transport per pound of ammonia.

It will be noticed that the washer also serves as a second absorber. The heating of the weak liquor in the heater is accomplished by the vapours passing through lead coils on their way to the condenser, and the condensate produced thereby is returned to the still. The condensing of the vapours takes place in a lead coil, surrounded by cooling water in the condenser, and in the absorber in which the concentrate is cooled by water passing through a lead coil on its way to the condenser.

All the parts coming in contact with ammonia vapours are made of cast iron and lead. All pipes liable to stoppages have connections for blowing-out with steam; but this is necessary only when starting the still, and is done in a few minutes. Each of the sections shown, with the exception of the section underneath the heater, has two compartments, so there are thirteen compartments in the still and two in the washer. Each compartment is provided with a large cleaning opening, covered with a faced cast-iron plate. The still shown is 24 inches in diameter and has a capacity of about 150 gallons of weak liquor per hour.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Alliance and Dublin Gas Company's Affairs.

Sir,—That the Manchester Directors of the Dublin Company are perpetuating the old Board's policy of reticence need not, by now, cause any surprise. Those who have followed my criticisms will appreciate the point. The experts' report was impounded, followed by a rapid candidature of the three new Directors, which was quite contrary to the line of thought first created when Mr. Dickens made his *début* to the shareholders. However, there it is! The glory goes o the bold warrior; so, at the last half-yearly meeting did our Manchester men accept honours—especially so of a comforting nature.

I thought at least that, with all these manifold blessings being showered on the three pioneers, some little comfort would have been hrown out to those who have laboured equally—at least, in their earnestness—towards the redemption of this unfortunate Company. But, no, the whirl of the meeting and the excitement of so brilliant a balance-sheet prevented any explanation of those pointed comments which I made on the preceding report and accounts—those to the 31st of December last. At any rate, even supposing I do not get any reply rom the new constitution, it only parallels with the attitude of the old Board, who wisely (?) held their peace. But the day came! Now I do not propose to let the affairs of the Dublin Company pass without uture criticism, even though the Board are reconstructed and backed-up by eminent experts to keep them right.

Let us take the last accounts. The working profit shown amounted o £59,340. Excellent! But let us examine closely. The comparison so naïvely made by the Chairman with the corresponding period of 1914 can be brushed aside—that was a sweeping-up period, a time of reconstruction, and as such the drop in profits had its own significance. No! Let us go back to 1912—a half year prejudiced by the great coal strike. Repeating the Chairman's words—"owing to the different orm on which the statement of accounts was presented, comparison with corresponding periods was impossible." This may be so, and we can conclude that the expenses [1915] charged to revenue were strictly egitimate, and no depreciation or special expenditure in any form or shape was included. What, then, did we get in 1912? A revealed profit of £47.350. Yes; but you say, that is £12,000 less than the last June accounts. Granted; but, in the first place, the price of gas was 2d. per 1000 cubic feet less in 1912 (Dublin gas is now at a minimum of 3s. 6d. per 1000 cubic feet); and this 2d. increase represents nearly £6000 for the half year. Then as to the balance, I suggest that the £12,203 charged to profit and loss should be put against revenue, in which case the gilt is at once taken off the gingerbread, or, in other words, the brilliant half-year's accounts for June, 1915, sink below the standard of the old *régime* during a very trying half year. Where was the great glory justifying such liberal recognition of the services rendered by the special Directors? I cannot see the justification; but, in any case, I throw out a challenge to the Board. I question whether I shall get an explanation; but there is no doubt, as time goes on, I will trace the comparisons. So much for finance.

Now for a few brief words otherwise. The Chairman attached great importance to the coal question, and to the valuable assistance rendered in this respect by the new Directors. Well, I have examined this point so far as reports are concerned, and find in June, 1912, the net cost of gas (coal and oil) was about 8⅓d., and for June, 1915, about ¼d. more per 1000 cubic feet sold. Nothing to boast about!

Then the total sales of gas show a decrease of nearly ¾ per cent., against a decrease of nearly ⅖ per cent. over the corresponding period. Not progressing in the sale of gas; and both half years in question under the control of the Manchester men.

Another point. The gas unaccounted for represents 12·8 per cent., against the June half of 1914 12·9 per cent.—again under the auspices of the new blood. The June half year of 1913 showed the unaccounted-for gas as 10·1 per cent.; and this was too high. Things are getting worse under this head.

I am still wondering where the blessings are coming from, and who is the Napoleon?

R. W. Edwards ["Nonulus"].

Oct. 14, 1915.

P.S.—The item, £8119 17s., for special purposes is a legitimate debit against the half-year's revenue, as is clearly emphasized by the model clause—"The directors of the company may, if they think fit in any half year, appropriate out of the revenue of the company *as part of the expenditure on revenue account* . . . ;" and this is borne out by such charge being, when spent, an allowance by the income tax authorities. Why then put it against the profit and loss account?—R. W. E.

Control of Gas Passing through Purifiers.

Sir,—With reference to patent No. 844, dated Jan. 19, 1915, granted to G. F. H. Beard, J. W. Scott, and R. & J. Dempster, Limited, and described in the "Journal" for Aug. 24, I should like to point out that the proposed method of control of gas passing through the purifiers is by no means a new idea; it being the common practice carried out by engineers in this country [U.S.A.] for over twenty years.

By means of the Creighton valve, as extensively used in America, the method of control is much simplified, as only one control valve is required to each box, in place of two by the patentees' method. One connection from the Creighton valve passes direct to the centre or between the two layers of oxide in the box; the other connection communicates direct with the control valve. Assuming the gas passes between the layers, and upwards through the top layer and downwards through the bottom layer, it passes away through the top and bottom of the lute—both lute-valves being open.

Reverse flow is obtained by reversing the inlet and outlet of the connections to the purifier at the Creighton valve, which does not in any way interfere with the course of the gas in the other three boxes of the set, and can be completed in a few seconds. In case of excessive fouling of either layer, the top or bottom of the lute may be closed (or partially closed) and the gas made to pass upwards or downwards, or an excessive quantity of gas made to pass through one layer in case that layer is less fouled than the other.

In American practice, layers of oxide about 5 to 6 feet deep are used. By the above method much mechanical complication is done away with, and quicker control of the gas is obtained.

Chicago.

Sept. 26, 1915.

Incandescent Lighting and Calorific Value.

Sir,—I have read with interest the comments in your issue of July 27, on the "Composition of Gas in Relation to the Performance of the Bunsen Burner." I am inclined to think that your main objections result from the divergent connotations of the word "standard." As used in this country in connection with gas supply, it has come to imply a sort of secondary unit, of such a character that its numerical value is directly proportional to the usefulness of the product to which the standard is applied. For example, the candle-power standard, as applied to gas used in open-flame burners, expresses numerically and exactly the value of the gas for this purpose. One cubic foot of 20-candle power gas is worth precisely twice as much as one cubic foot of 10-candle power gas. It was my purpose to show that this relation does not hold with regard to the calorific value of gas used in the incandescent burner, but that the light output per cubic foot decreases with increased calorific value at the same rate as the calorific value increases.

You state that the general relation of decreasing light output per B.Th.U. to increasing calorific value is "now an accepted fact." This is evidently true of England; but it is not true of the United States. On the contrary, I appear to be quite alone in my adherence to this idea. In presenting the results of my experiments, I sought to establish the quantitative relations existing between these quantities. You grant that the statement is qualitatively true, but attempt to dispose of the quantitative relations by the mere statement, "It is not so." Now, when one tests a gas of 480 B.Th.U., and finds that 4·6 cubic feet give 116-candle power in an incandescent burner, and then tests a gas of 660 B.Th.U., and finds that 4·6 cubic feet give 116-candle power in the same burner, and numerous repetitions of the tests with substantially similar gases show similar results, I should like to know what you would consider a reasonable conclusion. My tests covered eighty different gases ranging from 480 to 660 B.Th.U. per cubic foot. The mantle candle-power was substantially constant, likewise the gas consumption—referring to averages of each range of calorific value of (say) 20 B.Th.U.

If these data are accurate, it is proved—at least, for this particular lamp—that light output per cubic foot is practically independent of calorific value; and if this be the case, how can calorific value be any more valuable than candle power as a term in which to express numerically the value of a gas for incandescent gas lighting?

Any challenging of this position must be based upon an equally exhaustive series of tests from which contrary conclusions may be drawn. Likewise, if one wishes to challenge the statement that flame-temperature affects efficiency in a majority of practical applications of gas, experimental evidence of a broad and comprehensive character should be submitted.

As to the desirability of prescribing certain ranges of specific gravity and calorific value for the regulation of gas supply, that is as obvious as the desirability of prescribing pressure ranges, and for the very same reasons.

It is quite apparent that no single property, or group of properties, of gas can be made to serve as a standard in which the usefulness of the gas may be numerically expressed, because no property bears any fundamental relation to all the others.

There is surely no objection to centring the requirement for gas supply around a specification of calorific value ranges, provided it is understood that this cannot be regarded as a standard in the same sense as gas candle power, and that under some circumstances the value of gas service to the consumer might be actually increased by decreasing the calorific value, even without a corresponding reduction in the price of the gas per cubic foot. This is now true as to incandescent lighting.

As regards the effect of flame temperature upon processes other than incandescent lighting, it is only necessary, in order to establish a reasonable presumption, to call attention to the supersession of the yellow-flame burner by the bunsen burner. For all processes in which flame temperature does not affect efficiency, there is surely little excuse for the bunsen burner. It is quite practicable to design nearly all appliances for yellow-flame burners so as to provide against the deposit of soot, and ensure the rejection of products of combustion at the same temperature obtained with the bunsen burner; and the yellow-flame burner is vastly cheaper and more convenient.

What percentage of the gas sold in England (except for open-flame lighting) is used in yellow-flame burners? Is not the preference for the bunsen burner in any application presumptive evidence that flame temperature, or its concomitants, plays an important part in the efficiency of utilization?

R. ffrench Pierce,
Welsbach Company's Illuminating
Engineering Laboratories.

Gloucester, N.J., U.S.A.,
Oct. 1, 1915.

[We are pleased to receive the foregoing letter from Mr. ffrench Pierce; but we wish it had been characterized by rather more lucidity, as it is very difficult to carry on a discussion without one knows precisely what is intended. In the first place, there must be dissent from the statement that we said in an article on July 27 (p. 175) anything quite so crude as that "the genera relation of decreasing light output per B.Th.U. to increasing calorific value is now an accepted fact." What was actually said may be gathered by reference to the article. From much of what follows in our correspondent's letter, it seems to us his failure to make correct deductions from the photometrical results that he obtained, using incandescent burners with gas of varying calorific value, is due to a want of appreciation of, or acquaintance with, certain well-established principles associated with gas combustion. Take this statement: "When one tests a gas of 480 B.Th.U., and finds that 4·6 cubic feet of it give 116-candle power in an incandescent burner, and then tests a gas of 660 B.Th.U., and finds that 4·6 cubic feet give 116-candle power in the same burner, . . . I should like to be informed as to what you consider a reasonable conclusion." In the first place, we cannot bestow the slightest comparative value upon tests carried out in the way described. A burner which, consuming 4·6 cubic feet of 480 B.Th.U. gas per hour, gives 116-candle power, ought not to be used at a fixed rate of gas consumption for all gases. The very fact that a gas of 660 B.Th.U. was used in the same burner at the same rate of consumption as the gas of 480 B.Th.U. (we take it, too, the same size mantle was employed) was not doing justice to the higher calorific gas. And though we are not advocates of a gas of such high calorific power for general purposes, we are for having the gas treated in a way that will allow it to give the best possible account of itself. One reason then why one or the other of the gases was not giving a proper result was that it was being imperfectly used. Another reason why the high calorific value gas was not doing better in total candle power than the other was that for complete combustion a larger quantity of air was required; and the larger the quantity of the inert constituents nitrogen and carbonic acid introduced to the gas and the flame, the greater the cooling effect upon the flame, and the greater the amount of heat taking flight with the products of combustion. For incandescent lighting, it is very important that anything which has a cooling effect on flame should be reduced to as low a point as possible, consistent with realizing complete combustion. As we do not, and cannot, admit the sufficient accuracy for fundamental purposes of the data supplied by our correspondent, we cannot agree that it is proved "that light output per cubic foot is practically independent of calorific value." Following which, our correspondent asks: "If this be the case, how can calorific value be any more valuable than candle-power as a term in which to express numerically the value of a gas for incandescent lighting." Flame temperature is a result of, among other factors, calorific power; it is not a result of candle power. We assume that Mr. Pierce means by "candle-power" the light obtained from a naked flame; he surely cannot mean candle-power as developed by an incandescent burner, as that would vary with the same gas according to burner, pressure, &c. It was shown recently in the "Journal" that, by removing from a gas the greater proportion of its benzol a 16·11-candle gas was reduced to 10·51-candle power—a reduction of 34·7 per cent. of luminous value. The calorific value of the 16·11-candle gas was 585·3 B.Th.U. gross; of the 10·51-candle gas. 559·1 B.Th.U.—a reduction of only 4·5 per cent. Perhaps this illustration will be sufficient to show Mr. Pierce how calorific value can really be "more valuable than candle-power as a term in which to express numerically the value of a gas for incandescent lighting." Then our correspondent remarks that "if one wishes to challenge the statement that flame temperature affects efficiency in a majority of practical applications of gas, experimental evidence of a broad and comprehensive character should be submitted." The conditions that produce a high-flame temperature, with a given consumption of gas, may not be the best for all purposes. In incandescent lighting, the less cooling nitrogen and carbonic acid that are introduced into a flame through the air supply, the better; and the greater the proportion of hydrogen in the mixture, the smaller the volume of the flame, and the higher the temperature of the flame. And the photometric intensity of the light from a mantle increases very rapidly with the temperature of the flame—the mantle being thin it rapidly emits the light radiations due to its incandescing. But the conditions are different in a gas-fire. A long flame, and a flame of larger volume, is required, for the larger area of heat-radiating surface. Practicability has to be taken into the reckoning. Under the circumstances of the gas-fire, we do not need the condensed high-temperature flame that is the best for service in the incandescent burner. Take, again, the water-flow calorimeter. There the high-temperature flame has no particular virtue; all that is required is that the heat energy of the gas is allowed to give full account of itself. The same with water heating by gas. The same, too, in furnace heating, in which volume of flame is required to do the work. These are matters upon which to-day there is no necessity for "experimental evidence of a broad and comprehensive character." They are generally quite well appreciated. Regarding the point that "for all processes in which flame temperature does not affect efficiency, there is surely little excuse for the bunsen burner," also what is said as to yellow flames, and the final question, "Is not the preference for the bunsen burner in any application presumptive evidence that flame temperature, or its concomitants [what is meant by this we do not exactly know], plays an important part in the efficiency of utilization?"—all that it is necessary to say is that the use of the bunsen burner is largely a matter of convenience and working efficiency. Perhaps Mr. Pierce does not know that, in the standard calorimeter in this country, flat-flame burners are employed—apparently for the reasons that a high combustion chamber is unnecessary, and that the luminous flames have the effect of distributing the heat. In view of this, if Mr. Pierce were right in his contentions, then Professor Boys, the Metropolitan Gas Referees, and all who have endorsed the use of flat-flame burners for assigning to gas, under the conditions of the calorimeter, its total thermal value ought to be downright ashamed of themselves.—Ed., J.G.L.]

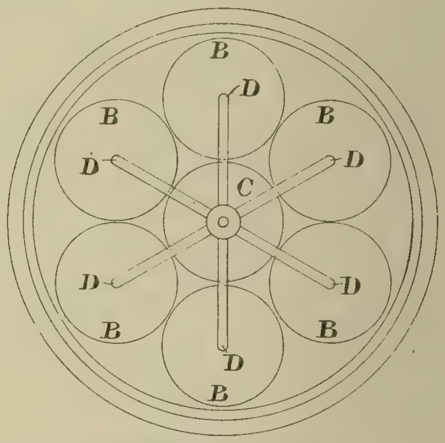
REGISTER OF PATENTS.

Gas-Governors.

M'Lachlan, R. W., of Enfield Highway, N.

No. 21,626; Oct. 28, 1914.

This invention refers to constant pressure gas-governors in which valve controlling devices on the metallic bellows principle are used. A type of such devices will be seen in patents No. 463 of 1906 and No. 24,466 of 1913. The object of the invention is to obtain a greater capacity of gas by the use of larger valves than those which can be controlled by the use of a single metallic bellows controlling device which, "owing to the weight of metal required to construct these bellows, it has been found that a single bellows cannot be conveniently made to lift and control valves sufficiently large in diameter to give the desired capacity of gas required in constant-pressure service governors."



M'Lachlan's Gas-Governor.

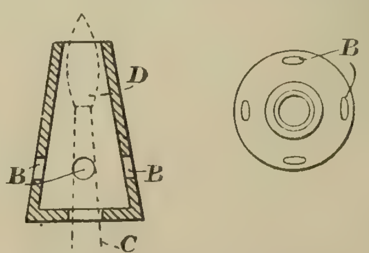
The improvement is as follows: A number of metallic bellows made of light material and of suitable size are fixed together, and applied to a valve of suitable diameter, as shown in the engraving—a top view of a governor casing with its cover removed and showing a number of bellows mounted on a base-plate and connected together, and applied to a valve rod. The bellows are connected to centre bellows C by the plates or strips D, thereby causing all of them to work uniformly together, "and having seven times the amount of controlling power over the valve than the single bellows."

Pilot Lights for Gas-Burners.

Rasch, L., of South Norwood, and Watkinson, F., of Farringdon Road, E.C.

No. 4280; March 18, 1915.

This invention relates to pilot lights—comprising a jet surrounded by a truncated coned shield so disposed that the flame passes through the orifice at the apex; the cone being closed at the base and provided with holes near the base.



Rasch and Watkinson's Pilot Light.

A cross section and a plan are given of one form of shield—made in accordance with the invention. It is a hollow truncated cone of metal closed at the base, with holes B near the base to supply air to the mall flame or jet. The pipe C, carrying the gas to the jet D, passes hrough the centre of the base. Thus when the pilot light is burning he shield becomes hot and the air which supports combustion is warmed in passing through the holes near the base of the shield and by the surrounding metal. The air directed on to the flame is thus heated and produces a longer and hotter flame; so that, it is said, "the pilot light will not be extinguished even in a violent draught of air, or by explosion or suction."

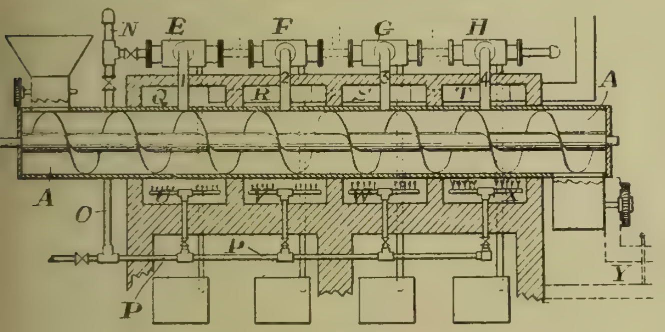
Distilling Volatile Products from Carbonaceous Material.

Prioleau, J. R. H. & W. L. St. J., of Trafalgar Square, Chelsea.

No. 9375; June 26, 1915.

This invention relates to apparatus for the destructive distillation of carbonaceous materials, of the type in which different volatile products are withdrawn from different parts of the retort; and its object s "to provide means for accurately varying the temperature over a eries of different zones in the retort according to the distillates required from the particular zones."

The inventors propose to employ a single-chamber surface-heated etort (whether vertical or horizontal) and in connection with it to divide-up a flue space or jacket surrounding the retort by means of ransverse partitions, which definitely separate the length of the retort externally into a series of zones. In each zone a separate furnace or burner with independent control for the supply of a heating medium hereto is provided; so that the successive zones may proceed either with a gentle and successive temperature increase, or by temperature differences of considerable amount, or, again, by an increase and then a decrease as desired. Connected with each zone is a condenser, whereby volatile products due to the temperature at which the particular zone is kept are quickly, directly, and simultaneously withdrawn.



Prioleau's Coal Distillation Apparatus.

A particular method to which the invention is especially applicable s set forth in patent No. 23,165 of 1914 [see "Journal" for Sept. 28, p. 711], in which the condensers are operated by a cool non-condensable gas; and the accompanying illustration shows its adaptation hereto.

A single chamber retort A is carried in a furnace setting having the partition walls definitely dividing-up the surface-heating flues into zones Q, R, S, T; and separate burners U, V, W, X, are arranged in he respective flues, each controlled by a valve. The conveyor screw shown is for slowly traversing the material through the retort.

The several supply pipes are connected to a main supply pipe P, which may, in turn, be supplied either from the gas supply O, coming rom the retort through the condensers by a pipe which connects to he pipe N, near which the valves are arranged which distribute the non-condensable gases to the condensers and the gas supply pipe O. Necessary washing, cooling, or other apparatus is arranged between he two pipes.

In the concurrent application volatile matters are directly and simultaneously removed from the retort by pipes 1, 2, 3, 4—such volaile matters varying according to the temperature of the several zones; and they are immediately condensed in a series of ejector condensers E, F, G, H, by cool gases supplied from the pipe N, and the distilates removed through pipes provided for the purpose.

There are openings from each zone into a common flue to the chimney arranged in the side wall of the retort; but by the use of dampers and auxiliary flues, or by connecting passages (shown dotted) hrough the walls, the hot gases may be carried from one zone to another—dampers being provided to vary the path of the combustion gases as desired. Air for combustion is admitted by openings beneath he burners, or by dampered openings in the base of the side walls.

The final product from the conveyor will be coke; and in order to get this of a harder character, a chamber shown dotted at Y may be employed in which the coke coming out of the delivery shoot is heated up to about 800° C. It is provided with additional heating apparatus not shown) for the purpose.

Gas Cooking Apparatus.

Noonan, J. H., of Auckland, New Zealand.

No. 11,269; Aug. 4, 1915. Convention date, Aug. 5, 1914.

This gas cooking apparatus is intended to provide means whereby any number of utensils containing food may be heated or kept heated at the same time.

The apparatus comprises a central gas distributing chamber connected with a gas service; heating burners, with supporting legs and upper projections, arranged around and connected to the chamber; gas-cocks controlling the gas supply to each burner from the central chamber; and an illuminating burner fitted with a gas-cock, and connected to the central chamber. Stand burners are arranged round, and connected to, a central gas distributing chamber—each burner being supplied with gas from the chamber through an independent gas-cock fitted in the wall of the chamber.

LEGAL INTELLIGENCE.

DUNDALK VALUATION APPEALS.

At the Dundalk Quarter Sessions last Wednesday week, before his Honour Judge Green, K.C., the Dundalk Gas Company appealed against a valuation by the Commissioners of Valuation of £800 on their premises; and the Dundalk Urban Council appealed against the valuation on the ground that it was insufficient. The Council also appealed against the valuation made by the Commissioners on their electricity undertaking.

Mr. Henry Hanna, K.C., appeared for the Gas Company; Mr. J. C. Lardner, B.L., for the Urban Council; and Mr. Gartlan, for the Commissioners of Valuation.

Mr. Hanna, in opening the Gas Company's appeal, said the amount of the valuation that had been fixed by the Commissioners on their undertaking was £800, of which £500 was for the house and works, and £300 for the mains and easements over the streets. The undertaking was carried on under an Act passed in 1887. It was necessary to point out to the Court, in considering the question, the falling off in receipts of the Company in recent years. The Council in 1912 started an electrical undertaking; and the evidence would show that the year before this undertaking was commenced the Gas Company's profits were £2748. The result of the electrical undertaking had been that in 1914 his clients' profits were only £1731; so that in three years they had fallen by £1000. This was due to the success of the electrical concern, which was able to take from the Company some of their very best customers; and they were tied by the agreement not to take any other form of light. Not only were their profits reduced, but they had still the same expenditure in many ways. Except a possible reduction of coal, there would be very little change in the expenses of carrying on the works. Up to 1914, the undertaking was valued at £1070. When the Company served notice, the Commissioners of Valuation had the works revalued, and reduced the figure to £950. They did not appeal to Quarter Sessions on that occasion; but when they came to this year, the Directors, being faced with the position that they were paying rates upon a very large amount, and the electrical undertaking on a very small amount, served notice on the Commissioners for a further reduction, who reduced the amount to £800. The valuation of the electrical undertaking was only £440. Of course, the electrical undertaking was the property of the Municipality; but this was no reason why it should be valued at such a low figure. He was not concerned as to whether or not the electrical undertaking was carried on at a profit. The Gas Company contended that, so far as their business was concerned, the valuation of £800 should be reduced. Explaining the system on which these valuations were arrived at, Counsel said that, after making the usual deductions, there would be a balance of £536, which the Company maintained was the net profit on the undertaking. A rate of 6s. in the pound on this would be £160. The business of the Company had gone down one-half in three years, while their valuation had only gone down one-fifth.

Mr. *William Cheeke*, M.Inst.C.E., gave figures on which he said the rateable value of the undertaking would be £370.

Mr. *George Airth*, the Manager of the Company, said the reduction of profits between 1911 and 1914 was 37 per cent.; the output declining from 54½ to 44½ million cubic feet. They had lost the contract for street lighting; and the lamp standards were useless. They had been refused permission to put gas in the municipal houses. Between 1911 and 1914, the reduction of receipts from the Great Northern Railway Company was £150; and they had made a contract with the Urban Council to take a certain amount of electricity from them which would further reduce their consumption of gas. The Steam Packet Company had electricity at 4d. per unit, on condition they burned no gas.

Mr. Lardner said there was no such condition.

Witness (continuing) said that in Dundalk the gas undertaking paid 12·84 per cent. in rates, in Drogheda 4 per cent., and in Armagh 8 per cent., on the cost per 1000 cubic feet of gas.

By Mr. Lardner: In 1905, when there was no electric light, the make of gas was 42 million cubic feet. The price of gas was then 3s. 11½d. per 1000 cubic feet; and it was now 3s. 9d. At present there were 558 cookers in use in Dundalk; and in 1905 there were 58. For renewal of works they paid 6d. per 1000 cubic feet. All told, they had about 25 gas-fires in Dundalk.

Mr. *Isdell*, for the Council, said the average net receipts of the Company for three years were £2603. He submitted calculations, the valuation on the basis of which was £993. He thought there was a great future before the Company.

Mr. *Carberry*, Reviser for the district, deposed that the first assessment on the Gas Company was £1020, and last year the figure was reduced to £848. He did not make the valuation himself. The Commissioner of Valuation sent him the papers, and asked him to explain the figures. They were based on 1912-13-14.

Mr. Hanna objected to Mr. Carberry giving evidence, as he had not valued the works himself.

Mr. Lardner, addressing the Court, said the Company were going through what other companies in similar circumstances had had to go through; and when this was over, they would come into their own. The Council would be glad to see them prosper. A new field of work was opened up to them in gas heating and cooking. The figure of £370 for the valuation put forward by Mr. Cheeke was altogether disproportionate. Though they might be staggered for a year or two by the electrical undertaking, they had now come back to their own. Another thing the Court would have to take into consideration was the fact that the electrical undertaking had reached its maximum; and the cloud on the Gas Company had passed away. He held that the old valuation of the Commissioners should be reinstated.

Mr. Hanna said there were two facts that could not be explained away—the decrease in the profits of the Company, and the falling-off in the output of gas. The valuation had only been reduced from £1000 to £800, while the profits had decreased by 33 per cent. The valuation of £800 should be substantially reduced.

His Honour reserved his decision in this case until after hearing the Council's appeal as to the valuation of the electricity undertaking.

Mr. Lardner pointed out that the electric lighting undertaking was started by the Council in the year 1912. It was a small thing in the beginning; and the valuation fixed by the Commissioners was £50 the first year, with no sum assessed on the rates for overhead and underground cables. The valuation was now increased to £440—being £140 on buildings, and £300 on right-of-way for cables. The Council appealed to the Commissioners on the ground that it was too high. At the same time, the Gas Company appealed on the ground that it was too low. The result of the appeal was that the Commissioners left the figures as they were originally fixed. In this case, they took the highest year of three for the purpose of valuation.

Mr. *P. A. Spalding* deposed that the total expenditure on the undertaking was £33,265; and when he made deductions for tenants' fittings, the net amount was £22,231.

By Mr. Hanna: He was aware that the Gas Company's paid-up capital was £22,000.

Mr. *Isdell* arrived at a valuation for the whole concern of £255.

Mr. Hanna then submitted that the valuation should be increased somewhat.

Mr. *Cheeke* presented a valuation of £487.

His Honour announced that the Magistrates fixed the valuation of the Gas Company's undertaking at £734, and of the electric lighting concern at £418. They considered in the former case that the average for two years was the fairest method of arriving at a valuation.

Mr. Lardner asked if the Court had taken into consideration a deduction to make relative.

His Honour said they had made a deduction of 15 per cent. to make relative.

Mr. Lardner said he thought they were not entitled to do so; and he quoted a case in which it was held that it was not legal to make such a deduction.

His Honour: It is a matter of common practice that it should be done.

Mr. Lardner: I am raising the point on specific instructions.

His Honour: It has never been raised before here; and it is extremely awkward to have it raised now.

His Honour (after another retirement) said the Court considered the valuation made by the Commissioner in both cases was fair.

Mr. Hanna applied for a case to be stated, on the ground that the decision of the Court had been given before the point was raised, and that Counsel was not entitled to know whether relative value had been taken into account.

His Honour thought he could not state a case excepting on the question as to whether they were entitled to make a "relative deduction." He could not see on what principle of equity or justice this question had been raised by the Council, having regard to the practice adopted in the Court openly for years. He could not see what principle of justice would be served by abandoning this principle; and he could not say what reasons the Council had for raising it.

Mr. Hanna: They had a reason—that the party against whom it is to be enforced is the Gas Company.

Mr. Lardner said that, having regard to his Honour's remarks, he was instructed by the Chairman of the Council to say they would leave the cases in his Honour's hands to deal with them as he wished.

His Honour: I am much obliged to the Council. The valuations in these cases will remain at the figure settled by the Commissioner of Valuation.

Economy at Middlesbrough.—It is reported that a specially appointed Committee on Economies have recommended to the General Purposes Committee of the Middlesbrough Corporation that, among other official changes, the appointments of Mr. David Terrace (the Gas Manager) and of Mr. G. F. Blincoe (Assistant-Manager) be terminated, with a view to a Manager being appointed to take sole control of the undertaking. Numerous reductions of salary were suggested.

Lighting Matters at Wantage.—At the Wantage Urban District Council meeting last week, the Gas Committee submitted the annual balance-sheet, and, in view of the favourable results, recommended that the price of gas be raised to 4s. per 1000 cubic feet only, instead of 4s. 2d., as previously decided, and that £50 be allocated to the relief of the rates. Mr. A. J. Belcher (the Chairman of the Committee), in moving the adoption of the report, mentioned a few figures by way of comparison. He said that more than £100 extra had been paid for coal; but the income from private consumers was up £178. They had made a gross profit on the year of £452, in spite of the fact that the price of gas was reduced 5d. per 1000 cubic feet. With regard to the proposal to allocate £50 to the relief of the rates, the Chairman said they did not consider it advisable to deplete the balance further, in view of the fact that before long it would be absolutely necessary to provide a new holder, which would cost at least £1000. The report was adopted.

Swansea's Restricted Lighting.—The Swansea Highways Committee have, on the suggestion of the Borough Surveyor, agreed to the following arrangements in connection with the public lighting. Generally speaking, every alternate lamp not to be lighted; this not to apply to electric lamps, as these are in series of nine, and one could not be extinguished without affecting the nine. Public lamps at street corners to be kept lighted. The whole of the remaining lamps to be turned off at midnight. Lamps at refuges or islands situated in the carriage-way at the junction of two or more roads to be kept lighted all night. Arrangements as to the reduction in price are to be made with the Electricity Department; but with regard to the Gas Company, they have agreed that the total quantity of unconsumed gas be not charged for. The Company at their own expense are to take down the lanterns, burners, &c., and carefully store them until the Corporation require them to be refixed. Inasmuch as the lighters and extinguishers of the Company will be required to go practically the same rounds, the Corporation are to bear half the estimated loss of 18s. per lamp. The estimated net saving to the Corporation over the twelve months is £4000.

MISCELLANEOUS NEWS.

LEEDS UNIVERSITY DEPARTMENT OF COAL GAS AND FUEL INDUSTRIES.

The Report of the Livesey Professor.

There has just been issued the report that Professor John W. Cobb, B.Sc., F.I.C., made to the Chairman (Alderman C. F. Tetley, M.A.) and the members of the Livesey Advisory Committee on the work of the Leeds University Department of Coal Gas and Fuel Industries for the session 1914-15.

Professor Cobb begins by pointing out that the influence of the war was indicated at the opening of the session by a complete reversal of the progress in numbers which he had been able to report in the two previous sessions. Of last year's students who would normally have been at work this year four now hold Commissions; and the Department is also represented in the Royal Army Medical Corps, the Public Schools Battalion, and other branches of the Service. Two students who were to have continued research left to meet the demand for special help in the gas industry. One student who had entered the gas industry returned to the Officers' Training Corps, and has now obtained a Commission. Of the two senior students who remained, one to take a diploma and the other an honours degree, the one is awaiting a Commission and the other has volunteered for special chemical service. The temporary depletion of the department of its students has therefore gone very far; but the demand which seems certain to become insistent in the near future, for scientifically trained men in all industries, can be relied on to correct this shortcoming.

Special Lectures.

These were arranged for Tuesday and Wednesday evenings in the second term. The eight Tuesday lectures were in Bye-Product Coke-Oven Practice, and were given by Mr. Greaves, F.I.C., of the Otto Coke-Oven Company. A large entry was not expected; but it was thought advisable to offer the opportunity of attendance in view of the increasing importance of the industry, and having regard to the probability that the technical control of these plants would, during and after the war, be more exclusively in the hands of our own people. Nine students attended; and, on the conclusion of the course, three Saturday visits were made to typical coke-oven plants on which the coking process, the recovery of ammonia, benzol, toluol, and other tar products, as effected by different methods, could be seen and compared—viz., the Nunnery Colliery Company, the Middleton Colliery Compuny, and the Ackton Hall Colliery Company, who were duly thanked for their kindness in this connection, and also the officials of the firms who gave so freely their time and attention to the work of demonstration and explanation. The entries did not warrant proceeding with the lectures on the distribution and uses of coal gas, and on gas-producer practice, arranged for Wednesday evenings.

Evening Laboratory Work.

During the second term the laboratories were opened on Wednesday evenings for a limited number of students; and this year three students of gas engineering and three of metallurgy attended for instruction in practical laboratory work. Three of these had attended in the previous session. The primary purpose of the laboratory course is to supplement by more advanced work the training of students who have already gone as far as the equipment of the technical schools allows. It is also designed to use the laboratory and its equipment for the advantage of men whose general scientific training had been completed, but who on entering industries find the advisability of acquiring more special knowledge concerning the control of fuel supplies and fuel-using appliances, and the use of pyrometers and modern methods of metallography.

Research.

The Joint Committee of the Institution of Gas Engineers and the University of Leeds has continued work and presented its second report in regard to ventilation. The draught-proof building specially erected for the work has shown under repeated tests that it serves its purpose, and experiments have been made with results of a much more definite and reliable character than could have been obtained without it. Most immediately applicable to practice is probably the demonstration that even the most modern types of gas-fires differ so much among themselves in the degree to which they effect the ventilation of a room when burning under the same conditions. The usefulness of the work of this course would not, Professor Cobb thinks, be questioned. He thanks Mr. W. Harrison, M.Sc., the Research Chemist, for the zeal and ability he has displayed in carrying it out.

A paper, entitled "Thermal Conductivity of Refractory Materials," by Messrs. G. Dougill, M.Sc., H. J. Hodsman, M.Sc., and J. W. Cobb, B.Sc., embodying the results of research which had occupied the department for two years, was read by Professor Cobb before the Society of Chemical Industry, Yorkshire Section, and appeared in the "Journal of the Society of Chemical Industry," for May 15 last.* It deals with a new method which can be employed for determining the thermal conductivity of refractory materials in the forms in which they come into use in furnace construction, as bricks or blocks. Fire-clay and siliceous bricks and silica and magnesia bricks were examined at different temperatures. This work has been continued during the session with the assistance of Mr. H. M. Wolfe, who has studied the conductivity of bricks of bauxite, carborundum, and chromite. Fire-clay bricks specially made by the Farnley Iron Company, of different degrees of porosity, have also been tested to enable the influence of this factor to be more specially determined, and the alteration of the influence with temperature.

A paper presenting the more purely scientific aspect of the department's work, on the thermal phenomena of carbonization and the "Correlation of Thermal and Chemical Phenomena," was read before ıe Chemical Society on June 3. The authors had examined cellulose, ehydrated cellulose, and lignite, intermediate stages in the conversion wood into coal, and also pyridine and pyridine-chloroform extracts coal supplied to them by Dr. Wheeler, of the Eskmeals Laboratory. he paper, entitled "A Thermal Study of the Carbonization Pro- ess," was by Messrs. Harold Hollings, M.Sc., and J. W. Cobb, B.Sc.; ıd it appeared in the "Transactions" of the Chemical Society for)15, Vol. CVII., p. 1106 [*ante*, p. 24].

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* See "Journal," May 25, p. 454.

Mr. Hodsman, Assistant Lecturer and Demonstrator, and Professor obb have carried out the preliminaries of a research on toluol which, e considers, may be of some service.

Gas Research Fellowship.

Mr. Hollings resigned the Gas Research Fellowship on his elec- on to the 1851 Exhibition Scholarship. He has been allowed to sus- end that scholarship and to enter the laboratories of the South etropolitan Gas Company, where he has been engaged at first in search and later on special war work. With the approval of the resident of the Institution and theChairman of the Livesey Advisory ommittee, it was decided not to advertise the vacant Gas Research ellowship, and the position has not been filled, although it is pro- osed to proceed to the election of a fellow at any time when circum- ances suggest the desirability of taking this course.

Refractory Materials.

At the invitation of the Council of the Institution of Gas Engineers, rofessor Cobb joined its "Committee on Refractory Materials," and ımerous tests of such materials have been made during the session the laboratory.

Corbet Woodall Scholarship.

By the generosity of Sir Corbet Woodall, the report points out, a nd was placed at the disposal of the Institution of Gas Engineers r the endowment of a scholarship in gas engineering; and the Special ommittee appointed by the Institution to deal with the matter ecided that the scholarship should be made tenable at the University Leeds. The Senate and Council of the University in turn wel- omed the proposed new scholarship, and details as to the mode of lection and the course of training have been settled and are set out the "University Calendar" (1915-16). There will, however, be no ection this year.

Museum.

The most noticeable additions to the museum made this year are odels of vertical and inclined retort plants, loaned by the Vertical etort Syndicate, and Goodall, Clayton, and Co. Such models of ant are not only interesting as exhibits, Professor Cobb mentions, ıt extremely useful in lectures; and it is hoped that a considerable ollection of them may gradually be made.

A number of prominent firms in the gas, coke-oven, and allied in- ıstries had offered facilities for placing students in works during the ng vacation, but it was only possible to take advantage of their kind- ess to a limited extent.

Finally Professor Cobb records his appreciation of the value of the rvices rendered to the department by Mr. H. J. Hodsman, M.Sc., s Assistant Lecturer and Demonstrator—a value increased by the lls which have been made and are being made upon the department assist in special work arising out of the war.

EVIDENCE ON FACTORY LIGHTING.

An indication is given to-day of the evidence of the witnesses ex- nined at the third and fourth sittings of the Home Office Depart- ental Committee on Lighting in Factories and Workshops. When the ommittee resumed their sittings after hearing the evidence outlined in st week's issue [*ante*, p. 98], the first witness examined was

Mr. *Albert Stokes*, Chief Inspector of the South Metropolitan Gas ompany. He said that Mr. *Somerville*, who appeared with him, had een making some tests for them at various factories and workshops hich the Company had lit with gas. At that time [May, 1913], wit- ess said, the Company had contracts running for more than 250 fac- ries and workshops, in which were installed some 10,000 lights. In ıese cases they contracted to supply and keep the burners in good ondition, and to maintain the illumination at the standard which the nployer required. The industry carried on in South London was incipally the manufacture of domestic requirements and clothing. here was also a small amount of engineering. The Company under- ook a great deal of fitting work in connection with the lighting of ıese factories and workshops. During the last six or seven years, they ad made it their business to get in touch with the different places; ıd where there had been defective gas lighting, they had suggested im- rovements. The Company had always reckoned for the guidance of ıeir people that some standard of illumination should be provided to ıable them to say whether or not the factories were well lighted. Vhat they had done was to assume that, before they could say a place as not badly lighted, it was necessary that a minimum illumination f 3 foot-candles should be provided on all objects which were being orked upon, or upon the operation which happened to be going on. his had always been the minimum standard of illumination; and it as found necessary in a very large number of factories and workshops provide light considerably in excess of this. It was the opinion of is Company that the basis of specifying illumination should be the lumination on the object, rather than the taking of the candle power f the unit by which the place was lit, and measuring the distance from ıe unit on to the object which was illuminated. Employers were articularly anxious to get the very best light they possibly could. n fact, the Company had never found the slightest difficulty in per- ıading owners of factories and workshops to light their premises fficiently, or to bring their systems up to date. Many had said that ıey could get more work turned out if the light was good and pleasant the operator. He thought they would be inclined to agree to a eneral regulation specifying the maximum or minimum illumination. The minimum of 3 foot-candles of which he had spoken generally satisfied the workers. Complaints of insufficient light were frequent and well-founded if the lighting was such as to give less than 2·5 foot-candles. A great many trades, of course, required very much more light than the 3 foot candles. There was, for instance, a firm of theatrical costumiers, where the illumination given on the operators' bench was 6·5 foot-candles.

Replying to members of the Committee, witness said that trouble sometimes arose with regard to the position of the lamps, in the matter of throwing shadows over the work. If the Company submitted to a factory owner a design which was approved, and the lights ultimately proved to be not in a good position for the worker, the Company always undertook to alter them free of expense. The gas light they installed was entirely on the incandescent system. The colour and texture of the surface of work were important considerations as regarded the amount of light required for a given purpose. Asked if he had any suggestions to make to the Committee as to conditions in which exceptional difficulty might arise in carrying out any normal standard of illumination, witness said he had not; but he thought there would be a considerable number of these cases. If a low minimum standard of illumination were fixed, there were some factory owners who no doubt might be inclined to accept the minimum as the correct amount to provide. Factory owners were, however, so anxious to "speed-up" their works that the majority would not be likely to think it to their advantage to keep the light down too low. It was found, again, in two factories which were carrying on the same work, a light which was considered sufficient for one, was not for the other. In the same works, if the illumination was correct when white work was going through, the result would be very different when working on something of another colour. Generally speaking, a passage was well lighted with about 2 foot-candles. Handing in photographs, he pointed to one case in which, with good surroundings and a light wall, there seemed to be sufficient illumination with 1·7 foot-candles. In the great majority of cases, his Company provided considerably in excess of the 3 foot-candles he had mentioned. This was, in fact, a minimum which was not often used. In nearly all the factories fairly fine work was going on, and really good light was needed.

Sir Arthur Whitelegge: For any given kind of work, I take it that experience of the kind you have given us would enable us to say that a certain intensity of illumination is needed. Is there any physical test which can be suggested as a standard applicable to all such, or must it be determined by experience in each individual case?

Witness: I am afraid, so far as my experience goes, it would have to be determined in each individual case. I have given you the two factories where the workers were going through identically the same process in every respect. Although this was so, one factory owner and his workpeople did not agree with the views of the other. It would be very convenient if there were some definite method of deciding what was the correct amount of illumination to give for each particular trade; but witness did not think that many people would agree with definite and fixed standards.

Then it must be left more or less a matter of opinion?—That is my experience to-day—so long as a minimum is fixed.

Answering further questions, witness said all the work he had done had been in connection with ordinary inverted incandescent gas-lights. With these, the question of proper shading required attention, if the light was within the range of vision of the operator. If the light was behind the worker, he did not think it much mattered. In some cases, they adopted a globe ground half way up from the bottom. This threw the light against the reflector, and sent it down.

A series of photographs of installations put in were then explained by Mr. Stokes; the sizes of the rooms and the amount of illumination provided being given in each case. In the machinists' room of a theatrical costumier's, the illumination between the lights on the operators' bench was 5·28 candles, and under the light 6·5 foot-candles; while in a glass-cutting warehouse the figures for the plate-glass cutters' bench were 1·87 and 2 29 foot-candles respectively, and for the sheet-glass cutters' bench 5 foot-candles in the centre, and 12·5 foot-candles directly under the light. In a box-making and colour-printing works, there was 3·37 foot-candles illumination on the feeding table to the paper cutting and stamping machine; and in another place for folding large posters, there was a light in the centre of the bench of 2·5 foot-candles. Another example showed sewing machines with 16·6 foot-candles where the actual work was being carried on; and there was a laundry—which witness said was very well lighted indeed—where the illumination distributed over the whole area was 6·58 candles. For folding and book-stitching the light in one case was 6·66 and 6 candles respectively; in the packing-room, 4·33 foot-candles. At a hatter's, there was a general illumination of 6 foot-candles; and an operator said the light was only just sufficient to work by when black or dull-coloured straws were being machined. Where black-silk hats were being worked and examined for defects, there was an illumination of 20 foot-candles on the machine table between the lights. In a carpenter's shop, the illumination on the bench between the lights was 3 5 foot-candles, and directly under the lamp 5 foot-candles; while in the assembling and finishing shop, on the bench between the lights there was 4 66 foot-candles, and nearly underneath the lamp 6·33 foot-candles. The illumination on the bench in an ironing-room of a laundry was 4·16 foot-candles. In the case of a box-making and colour-printing works lighted by incandescent electric lamps, the illumination at the workers' stand in the printing room was 0·366 foot-candle, and in the gangway between the machines 0·088 foot-candle. This was very low, but quite sufficient, because the machines were automatic, and only required light where the boy stood. A corset factory, also electrically lighted, had an illumination of 0·766 foot-candle between the lights on the sewing table, 1·333 foot-candles at the table of the sewing-machine, and 0·525 foot-candle in the gangway between the machines. Probably the colours used would be mostly light; but the illumination was very low.

Mr. *A. P. Trotter*, Electrical Adviser to the Board of Trade, who pointed out that he appeared solely in his private capacity, as the Board had no connection with work of this kind, said that he had had over seventeen years' experience of compulsory regulations; and the more he saw of them, the less he liked them. A little education on the subject, through attractively published reports of the results of further investigations, would open the eyes of a good many manufacturers and others to the possibilities and advantages of good lighting. The side of the Committee's inquiry on which regulations might be of real value was lighting as affecting sanitation; and also if it was found that there were an appreciable number of accidents which might be prevented by better illumination, he thought regulations should be made on this head. As to glare, he considered this might be reduced, with a given brilliant source of light, by placing a white reflector behind it. The glare was in this way lessened. In the case of a powerful source of light with a black background, there was much more glare—it hurt the eyes more—than if the same light had a white background behind it. With very bright lighting, some system of shading the light from the eye was very desirable.

Mr. GASTER: If, for argument's sake, certain standards are prescribed and measurements can be made, what errors should be allowed for apparatus or individuals in the illumination of work?

Witness: In ordinary cases of steady lighting, there is no difficulty. I should say 5 or 6 per cent.; and there would not be very much advantage in going further, unless you are going to make penal regulations which say that the light must be up to so many foot-candles. In that case, I wish you joy of the last 1 per cent., in the event of any dispute arising.

You think between 5 and 10 per cent. would be accurate?—I think 5 or 6 per cent. for errors of observation, and the same for instrumental errors. I have no doubt a total of 10 per cent. would do.

Mr. *J. A. Hine*, Superintending Inspector of Factories in the North-Eastern Division, gave evidence regarding a number of processes requiring a good light; but in reply to the Chairman (Dr. R. T. Glazebrook), he admitted that he was not prepared with an exact definition of what was meant by "good." As a rule, the artificial lighting was fairly satisfactory. He could not remember when last he heard of a complaint about matters connected with illumination. If regulations were framed for a minimum standard in (say) a woollen or worsted mill, it ought to be considered that certain processes, such as spinning, required a much better light than others. He had never found any difficulty owing to bad lighting in getting about the yards of engineering works and foundries.

Mr. *Haydn Harrison*, speaking as an electrical engineer, said he had taken a considerable amount of interest in this particular question, as he did in all illuminating matters. He had found, with regard to factories, that complaints of insufficiency of artificial light came chiefly from people above a certain age; whereas the actual damage to the eyesight was more often done when the bad lighting affected the young worker, who did not complain. To a full output of work, there was no doubt good illumination was essential. He had seen in print a case referred to in connection with which it was pointed out that the output of the works was reduced by from 12 to 20 per cent. during the artificial hours of lighting. An instance was some time ago brought before the American Institution of Electrical Engineers in which a complaint occurred in a coil-winding factory that the workers were only able to wind sufficient coils at night time to earn 4s. 7d., whereas in the day time they were able to earn 8s. 4d. In regard to a general basis for illumination, he had always worked back to one unit—the necessary illumination for reading comfortably at the average time. This he had put at 2·5 foot-candles, which, of course, was high. Many people would say 1 foot-candle was sufficient for reading. For book-keeping, he said 5 foot-candles, for machine drawing (draughtsman's work), 8 foot-candles, for engraving 10 foot-candles, and for ordinary office work 4 foot-candles. For general factory lighting, where there was no local lighting at all, he had always arrived at 4-foot candles. Where there was local lighting, he calculated on a basis of 1·5 foot-candles for general lighting; and then the actual local lighting had sometimes been as high as 6 foot-candles. This was a settled American rule for ordinary factory work—speaking of engineering. In the case of brass-fitting work, he would be quite content with 4 foot-candles; but for work like iron and steel screw cutting, he generally put it at 8 foot-candles. For general lighting, with local lighting, he himself would consider 0·5 candle quite sufficient. Local lighting might be defined as the lighting of the area covered by the man working on a particular job. Foundry lighting was different from anything else. Unless there was a good shadow, it was difficult for the men to see; and with an increase in the general lighting, they wanted more local lighting. If any rules or regulations were laid down, the standard would have to be defined in terms of illumination, not of candle power. Of course, glare had a very bad effect on the eyes; but if it was tapered off—that was to say, if one had a high intrinsic brilliancy and a large reflector behind it, and tapered it off to something approaching the brilliancy of the surroundings—it did not appear to have this effect. When possible, however, he avoided any light-source in the range of vision where the intrinsic brilliancy was at all high.

Mr. *V. H. Mackinney*, Chief Engineer of Holophane Limited, said the tendency in America was to give a rather higher illumination than people were prepared to pay for in England. He gave evidence dealing with the practical possibility of complying with stated requirements as regards the provision of a certain value of illumination, and stated that he habitually executed installations on this basis—determining beforehand the illumination on the working plane that would result, and subsequently checking these values by the aid of an illumination photometer. Particulars were submitted of some installations tested in this way; and witness explained how, by a knowledge of the lamps and the type of shade or reflector employed, the desired illumination could be worked out and specified in advance. He pointed out that his Company had recently had designed in their laboratories a special line of steel reflectors for factory lighting. He also drew attention to the arrangement of lights recommended by them with a view to avoiding glare and unduly dense shadows, such as might be inconvenient to workers and productive of accidents. There was, he said, a tendency in local factory lighting to give more illumination than was necessary, and therefore one got a glaring effect. There was no reason why this local illumination should not be efficiently and economically controlled, just as general illumination was nowadays.

Mr. *J. S. Dow*, representing the Illuminating Engineering Society, laid stress on the value of measurements of illumination in factories. Such measurements, he remarked, were useful in order to provide a record, which, in view of the constant progress in methods of lighting, should be in future of great value to the Home Office; as a help to inspectors in studying installations, and thus gradually establishing standards; and ultimately as a means of testing the lighting in workshops, and ascertaining whether it came up to the requisite standard, when this was provided. A number of simple and convenient instruments for this purpose had been designed. He was strongly of opinion that measurement of the illumination in a room was preferable to specifying the candle power of lamps. Tests carried out by him showed that in well-lighted libraries a minimum reading illumination of from 2 to 3 foot-candles was found to be very usual. It might be desirable to specify ultimately a minimum value of general illumination, applicable to all workshops, and fixed with a view to providing sufficient light to prevent accidents, and also to specify the local or actual illumination required on the work in various trades. The general figure might be in the neighbourhood of 0·25 to 0·5 foot-candle; but he imagined that the special illumination would have to be fixed by experimental investigation in each trade. The latter should be measured on the spot where the light was actually needed; the former was usually taken in a horizontal plane 1 metre above the ground. In addition, an instrument intended for factory lighting should preferably be adapted to the measurement of surface brightness. It might be possible for the clothing trades, &c., to adopt a standard material having a given co-efficient of reflection, and to state the illumination needed for stuff of this kind, and to make an allowance for other materials grouped approximately according to their reflecting power. The amount of reflection derived from light walls and ceilings was a factor that should if possible be recorded when particulars of a lighting installation were being taken.

Mr. *H. J. Wilson*, Inspector of Factories, gave evidence as to accidents resulting from inadequate lighting, but chiefly relating to shipping. Referring to iron and steel works, however, he said he thought he was also within the mark in claiming that a certain proportion of accidents occurred through inadequate lighting, though the lighting of factories now was infinitely better than it was ten years ago. Speaking of light and the eyes, he remarked that a man was very rarely injured by a thing that he was gazing at. It was usually something which approached him from some other direction which caused the injury. It was the faculty for seeing an object which one was not actually gazing at at the moment that was important.

COAL TAR AND ITS DISTILLATION.

[Extracts from the "Iron and Coal Trades Review," Oct. 15.]

Of the many effects which the war has had upon commercial and industrial enterprise, one of the most important is that of compelling a better consideration of the possibilities of tar distillation, combined with the fractionization and rectification of the distillates. At gas-works considerable progress certainly has been made during recent years, though even there the subject has not received the attention it warrants, while at coke-works, with one or two exceptions, practically nothing had been done prior to the war. At such works, coal tar has hitherto been regarded merely as a valuable source of additional revenue incidental to the production of coke; little attention being paid to the extremely valuable products obtainable from it. There is no branch of chemical technology which can offer better returns for capital invested than that of the working-up of coal tar and its products.

Tar, of course, varies considerably in quality and quantity per ton of coal distilled, according to the class of coal and the temperature of distillation. It is an exceedingly complex substance, consisting of a mixture of more than two hundred different chemical compounds. For the moment, however, we may consider simply a few of the intermediate products obtained by a limited number of operations on coal tar. The figures here given are representative of an average tar; the quantities stated being obtained under everyday working conditions, and do not represent simply laboratory experiment results.

The primary distillation of one ton of average gas tar will produce approximately:

Ammoniacal liquor	5	gallons
Crude naphtha	5·6	,,
Light oils	26	,,
Creosote oils	17	,,
Anthracene oils	38	,,
Pitch	12	cwt.

Following upon the introduction of the continuous process of tar distillation, many tar producers have erected plant at their own works and are profitably distilling tar—the continuous process offering marked advantages in comparison with the older intermittent process. The following working costs of the continuous process, based upon results actually obtained in a plant dealing with 6000 tons per annum, will be found instructive and interesting:

Working Cost per Ton of Tar Distilled.

	s.	d.
Fuel	1	0
Labour	3	1
Interest and depreciation		10
Other charges		5
	5	4

The values of the products obtained from one ton of tar, based upon normal prices at the time being, were:

			£	s.	d.
5·6 gallons of crude naphtha		at 7d. per gallon		3	3
26 ,,	light oil	5d. ,,		10	10
17 ,,	creosote oil	4d. ,,		5	8
38 ,,	anthracene oil	3½d. ,,		11	1
12 cwt. of pitch		2s. per cwt.	1	4	0
			2	14	10
Less working charges				5	4
Net selling value			2	9	6

In the period under notice crude tar was worth 35s. per ton; so that he balance in favour of distillation was 14s. per ton, which repreents a net revenue increase of £4200 on the year's working.

In the continuous process of distillation there is no ground for the revalent idea that tar distillation is an intricate and offensive proess. Neither is it necessary to employ men for supervising the plant ho have had previous experience of distillation. The trouble of ffensive vapours is entirely non-existent. Also, in normal periods here is always a ready demand for the primary products.

Perhaps it will be of interest to further consider the treatment appliable to the various distillates for the production of the refined or emi-refined products for which there is a continually increasing deand. Among such products are:

(1) From crude naphtha and light oils: 90 per cent. benzol used for motor and chemical requirements; solvent naphtha used in the rubber industries; toluol used for chemical and explosive purposes.
(2) From creosote oils: Carbolic acid for disinfectants, explosives, &c.; cresylic acid for disinfectants and chemicals; naphthalene, for coal-tar colours and other purposes; creosote light oils for disinfectants and wood preserving.
(3) From anthracene oils: Creosote for timber preserving and other uses; anthracene for colours; alizarine, &c.

The products enumerated under item (1) are contained in the first two ractions obtained in the continuous plant, and can be separated thererom by additional plant of very simple design. One ton of average tar ill, from the crude naphtha and light oils, yield: 2·5 gallons of 90 per ent. benzol, 2 gallons of crude toluol, and 5·5 gallons of solvent aphtha. Therefore, the rectification of the naphtha and light oils roduced from a 6000-ton plant would yield:

	£
15,000 gallons of 90 per cent. benzol at 1s.	750
33,000 ,, solvent naphtha at 1s.	1650
12,000 ,, crude toluol at 1s. 2d.	700
	3100

Rectification on the continuous system is a very simple process, and alls for no special knowledge in its manipulation; the operation being ell within the capacity of a man of average intelligence. The plant elivers automatically and continuously crude benzol, crude toluol, and olvent naphtha. The working cost per 1000 gallons of crude oil disilled is as follows:

	£	s.	d.
Fuel		11	0
Labour		18	0
Interest and depreciation	2	2	0
Other charges	1	2	0
Total	4	13	0

On the 60,000 gallons, the working charges would therefore be £279. The value of the crude naphtha and light oils (60,000 gallons) before distillation would be £1500; and the value of the 90 per cent. benzol, solvent naphtha, and crude toluol obtained by distillation, after deducting working costs (£279), would be £2821—showing a net profit of £1321 on distillation and purification.

Referring to group (2) of the above mentioned products, one ton of average tar contains 3 gallons of crude carbolic acid, 3 gallons of crude cresylic acid, and 112 lbs. of naphthalene (crude). The 6000 tons of tar will, therefore, contain:

	£
18,000 gallons of crude carbolic acid at 1s. 6d.	1350
18,000 gallons of crude cresylic acid at 1s.	900
300 tons of crude naphthalene at 30s.	450
	2700

For the recovery of the tar acids (crude carbolic and cresylic acids) a very simple type of plant is required, in which the middle oils are washed with caustic soda which chemically combines with the tar acids, forming sodium carbonate and sodium cresylate. By heating the latter with waste carbolic acid gas, the tar acids are separated. The plant is generally arranged so that the carbolic and cresylic acids may be obtained separately, and the working costs are calculated upon this arrangement:

Cost per Gallon.

Fuel	1d.
Labour	2½
Interest and depreciation	2
Other charges	½
Total	6

It will thus be seen that, after deducting working costs (£900), the acids have a net selling value of £1350. Assuming the middle oils were disposed of after the first process of distillation, the value of the tar acids would certainly not have exceeded £750. The net gain due to the separation would, therefore, be £600.

Naphthalene in its crude form is used for agricultural insecticides, fire-lighters, &c. It is, however, recovered without difficulty by cooling the various distillates in a suitable apparatus, when the naphthalene separates out in the form of yellow crystals, which are freed from enmeshed oil by suitable means, producing crude naphthalene. As an average tar contains approximately 5 per cent. of naphthalene, the 6000 tons of tar would yield 300 tons of naphthalene valued at 30s. per ton, or £450, which, after deducting working charges at 4s. per ton (£60), would give a net value of £390. If sold with the original oils, the value would be about £200; so that the profit due to distillation is equal to £190.

There is perhaps nothing particularly noteworthy as to the financial results of the process; but when dealing with the various coal-tar dis-

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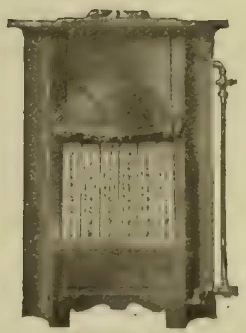

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tillates it is found a convenience to separate the naphthalene, in order to prevent blockages in pipes and passages. It may be pointed out that, owing to a shortage in supply, there is an excellent market for pure naphthalene; and as this product is worth approximately £18 per ton, there is a good margin on the refining process.

Anthracene is contained in the heaviest portion of the distillates obtained from the first distillation process. The yield is about 12 lbs. of 30 per cent. anthracene per ton of tar distilled, equal to 32 tons on the 6000 tons of tar; and the net value after deducting the charges would be about £80.

After having isolated the various materials previously referred to, the residuum is creosote oil; so that there are no working charges to be set against the creosote. As one ton of tar will produce 42 gallons of creosote oil, partly obtained from the creosote oil fraction and partly from the anthracene fraction, the 6000 tons of tar would produce 252,000 gallons of creosote oil, which at 3½d. per gallon is equal to £3675.

In summarizing the various working results here referred to, the following figures are worth very careful consideration. It should be further noted that the selling values are in every instance based upon the normal prices ruling in 1913:—

Value of 6000 tons of crude tar at 35s.	£10,500
Value of products of 6000 tons of tar after preliminary distillation process	14,850
Net value of products obtained by rectification of primary coal tar distillates as shown:	
15,000 gallons 90 per cent. benzol	2,821
33,000 gallons solvent naphtha	
12,000 gallons crude toluol	
18,000 gallons carbolic acid	1,350
18,000 gallons cresylic acid	
32 tons anthracene	80
300 tons naphthalene	450
252,000 gallons creosote	3,675
3600 tons of pitch at £2	7,200
Total net value	15,575

It will thus be seen that there is a net difference in revenue of £5075, due to the process of distillation as opposed to selling the crude tar.

As already stated, these results have been obtained under every-day conditions; and they have been amply substantiated in plants actually at work dealing with a combined output of 50,000 tons per annum; and when it is further stated that the complete cost of plant, including necessary buildings to effectively carry out the processes referred to, should not exceed £6000, it is obvious the subject might well receive the serious consideration of all tar producers.

[For the foregoing figures and the data our contemporary acknowledges indebtedness to Messrs. Hird, Chambers, and Hammond.]

BIRMINGHAM GAS-WORKS EXTENSIONS.

Further Plant for Nechells.

In a report which is to be submitted to the Birmingham City Council at their meeting to-day, the Gas Committee state that the requirements of the large number of local firms engaged in the production of munitions and war material are rapidly increasing, and make a heavy strain on the resources of the gas-works. Many of the firms are working day and night. The output of gas for the six months ended September was 13¼ per cent. greater than in the corresponding period of last year; and the demand is steadily increasing. It is not limited to the city, but extends to the important industrial towns of Wednesbury and Darlaston, which are also supplied with gas by the department. In these towns also many firms are employing double shifts in the production of munitions of war. The Committee therefore find it necessary to instal further carbonizing plant at once; and they propose to fill up No. 2 retort-house at the Nechells works.

When the erection of the retort-house and the installation of plant at Nechells was contemplated, the Council, in December, 1902, approved of an application to the Local Government Board for power to borrow £165,000 to cover an equipment of the daily capacity of 5,000,000 cubic feet. The sanction of the Local Government Board was received in June, 1903, and subsequently a retort-house was erected at Nechells, and plant installed which absorbed the greater part of the above-mentioned sum. It was not then necessary to erect all the plant originally contemplated; and consequently there still remains a balance of £35,000, which the Committee propose to apply towards the expenditure involved in installing the further plant now required to meet the probable demands of the manufacturers during the coming year. It will, however, be necessary again to ask the Local Government Board for their sanction to the application of this money, and also to obtain leave from the Treasury to raise the loan. They accordingly recommend that the Finance Committee should be instructed to obtain the necessary sanctions of the Government Departments, and borrow the sum of £35,000.

PUBLIC LIGHTING OF WESTMINSTER.

The Westminster City Council, at their meeting last July, approved and adopted a temporary arrangement [particulars of which were reported in the "JOURNAL" for Aug. 3, p. 254] with the Gas Light and Coke Company, for continuing the public gas lighting of the city after Nov. 15 next, the date of the expiration of the existing contract, subject to a report by the Works Committee on the extent of light reduction to be effected.

At the meeting of the Council last Thursday, the Committee reported

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for embodying our 1915 perfectionments—these are all included in the entire range of our existing standard patterns, from the cheap 10-inch Fire of 25/- list price upwards.

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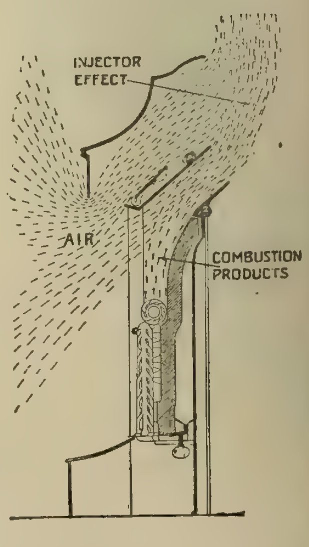
The ventilating air is drawn from all points of the room.

It is passed through the hottest part of the stove, so avoiding all possibility of high-temperature convection.

There is no admission of air-currents in such a way as to cool down the whole stove-body, on which we count for that proportion of low-temperature convection, the indispensableness of which we have all along emphasized.



JOHN WRIGHT & CO., ESSEX WORKS, BIRMINGHAM.

hat they now propose that the general standard of light in all the units at present supplied by the Company be reduced to two-thirds of the minima stipulated in the expiring contract. The alterations necessary to secure this reduction will be made by the Company without charge to the Council. The following table shows the rebate to be allowed on each class of lamp under the proposed arrangement :

Expiring Contract.		Proposed New Temporary Contract.	
Candle Power.	Price per Lamp per Annum.	Candle Power.	Price per Lamp per Annum.
	£ s. d.		£ s. d.
90	2 16 6	60	2 6 6
180	4 10 0	120	3 10 0
3)0	6 10 0	200	5 0 0
1800	15 10 0	1200	12 10 0
3000	22 0 0	2000	17 0 0

Subject to an addition or deduction of 3⅓ per cent. for every 1d. by which the standard price of gas for private lighting may exceed, or be less than, 2s. 6d. per 1000 cubic feet. The cost of the public gas lighting under the expiring contract is £13.496 per annum; and the cost under the amended contract, at the proposed scale of charges, is estimated by the City Engineer approximately at £10 745 per annum. The total estimated saving will thus be £2751 per annum, without regard to any further reductions consequent on future Government orders. On further reductions, the following allowances will be made.

Candle Power.	If not Lighted.	If Reduced		
		By One-Half.	By Three-Fifths.	By Two-Thirds.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
60 each .	0 16 8	0 8 4	..	..
120 ,, .	1 13 4	0 16 8	..	1 2 3
200 ,, .	2 13 4	1 6 8	1 10 0	..
1200 ,, .	5 6 8	2 13 4	..	..
2000 ,, .	8 13 4	4 6 8	..	5 15 7

Subject to an increase or decrease of 6⅔ per cent. for every 1d. increase or decrease in the price of gas above or below 3s. per 1000.

The report was adopted.

The Nautilus Company, Limited (owned by the Davis Gas-Stove Company, Limited), have recently been entrusted with the interior decoration of the new show-room of the Blackburn Gas Department, of which Mr. A. Morton Fyffe is Engineer and General Manager.

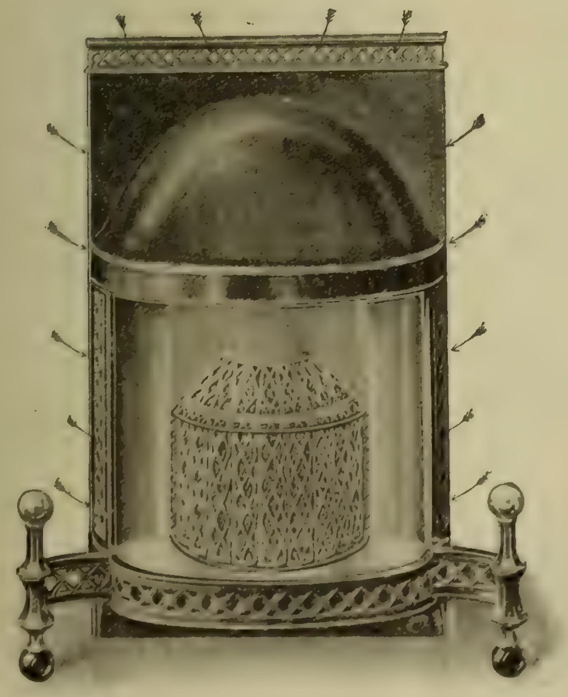
KEIGHLEY GAS-WORKS RESULTS.

The accounts of the Keighley gas undertaking for the year ended June 30, which were submitted to the Town Council on Tuesday last, showed a gross profit of £11,313, and a net profit of £1832. Inasmuch as £2985 was to be transferred to the general district rate, there was a deficit of £1153 ; but as £5855 stood as a credit balance last year, this left a surplus of £4702. From this, a donation of £50 was recommended to be handed over to the Keighley Victoria Hospital. The gas made amounted to 399.495,000 cubic feet, equal to 12,568 cubic feet per ton of coal carbonized ; and the average price received for gas supplied by meter during the year was 1s. 9 9d. per 1000 cubic feet. There had been an increased sale of 12,000,000 cubic feet of gas, realizing £1316.

Mr. J. Harrison (the Chairman of the Gas Committee), in moving the adoption of the report and accounts, said the war had seriously affected the usual smooth working of most gas undertakings, and considerably depleted profits. Their own undertaking had borne its share of the depressing conditions. In the estimates of the year's working under review, the total gross receipts were put at £52,131, and the expenditure at £38,784 ; whereas actually the income was £50,521, and the expenditure £39,208. The receipts from coke were less by £1243, and from tar by £1498 than estimated for ; but the increased receipts from gas had considerably reduced this deficit, leaving a total of £1610 less than in the estimate. During the last six months of the year, vitriol for the manufacture of sulphate of ammonia] went up in price by leaps and bounds, until eventually it reached almost double its former price. This seriously affected the net revenue derived from sulphate of ammonia sales. On the expenditure side, £424 had been overspent. Owing to various causes, coal supplies were delivered in small quantities ; and this forced the Committee to buy 1000 tons for immediate delivery at 6s. 6d. per ton advance, to ensure an adequate supply of gas to the town. This purchase alone represented £300, and if added to the extra charges against the department for war bonus (£112) and active service allowance (£207) made a total of £619. The increased charges for rates and income-tax further added to this total. But against this a very notable saving had been effected in purifying account, totally eliminating the charges formerly entered against naphthalene. Taking everything into consideration, the Committee considered the report very satisfactory. It might interest the Council to know that 20 per cent. of the gas made was being used by firms at work directly or indirectly on war materials for the Government. Also at the works arrangements had been made for extracting toluene from the gas. This process had been operated a considerable time.

Mr. Longton said the debt on the department was a comparatively small one—£48,748. They had a working capital account of £15,000, a suspense fund of £4652, and a renewals and insurance fund of £5207 ; giving a total of £24,859. For many years they had had funds amounting to £35,000 or £37,000 ; but they were spending out of these

The Twin Principles of the "R.H.D."



The "R.H.D." (Radiant Heat Distributor) showing ventilating principle.

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THE RICHMOND
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funds on other work. The department had difficulties to face, and one of them was in regard to interest. They had received in interest as much as £989—last year it was £722—but when their balances were spent there would be no interest to take into account. They had spent £16,906 on a new gasholder, and about £21,000 was being spent on new carbonizing plant. One of the curious things was that during last year coal cost £545 less than the previous year. Dealing with the increase of 5d. per 1000·cubic feet in the price of gas, he said the increased cost of coal—6s. per ton—represented something like £9535; whereas the increase in the price of gas only represented roughly £7488. It was stated in the report that the increased revenue from coke would probably cover this. It was rather a sanguine estimate, and he hoped it would turn out all right. They had dropped on lean times, so far as the gas-works were concerned. They had practically no money for the relief of rates; and the balance would soon be practically non-existent. Attention should now be given to the question of leakage, which seemed to him to be very large.

The report and accounts were adopted.

NOTTINGHAM GAS-WORKERS' WAGES.

Negotiations, the outcome of which at one period threatened potential danger to the continuity of efficient working in connection with the Nottingham Corporation gas undertaking, were brought to a conclusion on Friday.

There had been for some time portents of a storm; the activities of the officials of the Gas Workers and General Labourers' Union being persistently in evidence. A notable circumstance was the frequent visits of Mr. Will Thorne, M.P., the founder of the organization. To such dimensions had the undercurrent of disaffection been stirred, that there were ominous rumours that, after the Leeds *débâcle*, Nottingham might become the new battling ground. Originally, the City Council had agreed upon a comprehensive resolution, which took within its scope all the departmental workmen earning wages under 32s. a week; the decision arrived at being to grant a war bonus of 2s. to male employees who are married, to the single men over military age, and to the single men of military age ineligible for military service, and in receipt of 30s. and under per week. The resolution of the Council also provided that in the case of men receiving over 30s. and under 32s. weekly, the amount of their wages should be supplemented by such a sum as would raise the total to 32s.; the provision being that this additional sum should be paid as long as the war bonus is in operation. But the trade union extremists, through the influence of the organization which Mr. Thorne controls, quickly manifested their chagrin by the determination to bring a wider class within the fold. Their application was for the inclusion at the enhanced rates of those already in receipt of 32s. or a larger amount weekly, with the result that incidentally it was sought to establish that gas workers came for arbitration purposes within the scope of the Munitions Act.

The upshot of the matter has been that, following upon interviews during the last few days with Sir George Askwith in London, at which the cases on behalf of the Corporation and the workmen have been presented, the Gas Committee, at their meeting on Friday morning, acquiesced in the suggestion emanating from the Chief Industrial Commissioner that the increase in regard to the class of employees specified should be upon the basis of 2d. per day or shift. This met with the acceptance of the trade union leaders, who, however, made it a *sine quâ non*, that the same terms should be extended to the workers in the Electricity Department. Meeting at a later period of the day, the Electricity Committee agreed to act in consonance with the decision of the Gas Committee; and thus the matter has been settled, upon terms properly disproportionate to the inflated demands originally put forward.

COKE FUEL FOR STEAM-WAGGONS.

An account was given by Mr. G. W. Watson, Consulting Engineer to the Commercial Motor Users' Association, in last Wednesday's "Journal of Commerce," of the demonstration steam-waggon run from Wandsworth to Epsom, which was referred to in the "JOURNAL" for the 12th inst., p. 93. It may be pointed out that the comparative figures are based on a more favourable price for coal than for coke. Mr. Watson says:

Of the two Foden waggons, one is over three years old, and has been run entirely on coke fuel ever since it was new; the other waggon is not quite two years old. Both waggons, with their loads and trailers, were up to the legal limit of 20 tons gross. The coke consumed was carefully weighed, and the consumption over the give-and-take roads was 15¼ lbs. per mile run on the older machine, and 17¼ lbs. on the other one—an average of 16¼ lbs. per mile, or 0·8125 lb. per gross-ton-mile. The only point of difference between the two waggons and a standard Foden is the spacing of the fire-bars, which, for coke firing, have about 45 per cent. of air-space. The fire, too, is about double the depth one would allow with steam coal—that is, the top of the fire was only about 1½ inches below the bottom of the fire-door.

As a means of comparison with the above figures, let me take the admission of several users who were present at the trials, and whose vehicles regularly travel over the same road. With a gross load of 17 tons they find the rate of consumption of good Welsh coal averages 1 cwt. per 10 miles, which is equivalent to 11·2 lbs. per mile, or 0·66 lb. per gross-ton-mile. Resolving these figures into cost per vehicle mile and per gross-ton-mile, let me assume that coal costs 40s. and coke 25s. per ton. This being the case, the costs for coal fuel are 2·4d. per mile travelled, as against 2·18d. for coke, and 0·141d. per gross-ton-mile for coal, as against 0·109d. for coke.

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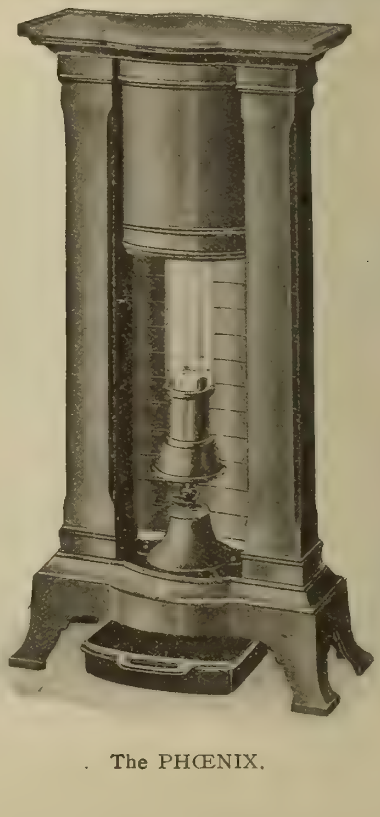

The PHŒNIX.

Of course, there are other considerations than cost of fuel. For astance, there is the relative bulk to be taken into account, as well as he greater tendency of coke to form clinker. But the latter objection as now been overcome by the use of a form of fire-bars which, ithout any mechanism, and merely by the vibration due to running, re kept gently rocking. True, coke is not the ideal fuel; but it is a ossible alternative, and as such its use should not be entirely ignored. Iany Lancashire waggon-owners have used it for years, and could not e persuaded to change.

The Editor of the "Commercial Motor," writing on the same matter, ays: Coke is more favoured in the North of England, and its use is ot uncommon there, chiefly because of the lower prices at which it an be bought. The relative values of coke and coal, in the writer's xperience, may be stated as follows: 15 lbs. of coke are necessary, in ractice, to do the same work as 10 lbs. of a good Welsh steam coal; oke at 25s. a ton is, therefore, equal to the best coal at 37s. 6d. Gas ompanies in the South will require to treat owners of steam-waggons nd tractors on a liberal basis, in order to encourage the consumption f coke. The same prices which rule for orders from householders annot be adopted. There is in force, at the present time, at least in ondon and the vicinity, a scale of discounts according to consump- on that seldom exceeds 15 per cent. on standard prices; and standard rices just now are unusually high. This uncommercial scale will not ring to the gas companies the business for which they are looking. Ve urge them to adopt a more generous table of discounts, varying ith the consumption of the individual buyer, and going, in the case f the largest consumers who own fleets of steamers, up to at least 30 er cent. They have a precedent set them by the large petrol import- ng companies, and these companies are controlled by astute minds. 'he large consumer must have consideration; and especially is this ue if he is being urged to change from a fuel to which he and his men re unaccustomed, or to revert to one which they have abandoned. 'he advocacy of coke, which is being systematically taken up by the ondon Coke Committee, and of which policy we find echoes in ifferent parts of the country, cannot be divorced from considerations f economy to the owner of a steam waggon or tractor.

With reference to Mr. Watson's figures, it is pointed out that it hould be noted that the coke consumption was determined on the utward journey only, under full-load conditions. This has been set gainst the average out-and-home coal consumption, with consequent dvantage in favour of coal. The Wandsworth Gas Company's pre- ious experience with coal has now been confirmed by further coal- onsumption trials, with the waggons used on the demonstration, under xactly similar load, time, and road-surface conditions. Although hese latter trials are not yet completed, the results so far go to show hat the actual coal consumption is little, if any, less than that of coke. 'arious grades of Welsh coal, varying in cost from 40s. to 45s. per on, are being used for the purpose of comparison; and the original oal-burning fire-bars have been temporarily re-fitted to the cars being xperimented with.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

A conference was held last week in the City Chambers, Edinburgh, between the representatives of the Town Councils of Edinburgh and Leith and the coal merchants in regard to the question of coal prices. The subject has been brought to the notice of the leading local authorities in Scotland, in order that, if possible, some steps may be taken to limit prices. There were also present representatives from the Glasgow Corporation Committee on Coal Prices, and of the coal merchants. The proceedings were private; but it is stated that there was a free interchange of opinion, and the question of margin came in for a good deal of discussion. The Glasgow representatives indicated what was being done in the West of Scotland; and it was ultimately agreed to adjourn the conference till next Thursday, when it is expected a decision will be arrived at.

Mr. James Purves, the Manager of the Ayr Gas-Works, has been fined £5 on a charge, to which he pleaded guilty, of having failed to obscure a light in the works which was visible from the sea. There was a dark curtain over the window; but as there was a space of some inches at either side, it did not obscure the light effectually. In addition, the curtain blew about, and thus gave to the light a flashing effect which, it was urged, "might very easily have been mistaken for signalling." It transpired that the light arose in connection with the "burning-out" of some retorts, and that Mr. Purves had taken every precaution he could think of against possible infringement of the Lighting Order.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Oct.* 18.

There are no new features to report in the London tar products market. Pitch is in small demand, except at prices which do not interest manufacturers. The feeling is prevalent, however, that it will be a good investment to hold pitch in stock, as at the present time shipowners would obtain by way of high freights a large slice of the value of pitch which should go to the tar-producer and tar-distiller.

The position of sulphate of ammonia is increasingly strong; and in view of the situation, makers are shy about quoting. For prompt delivery, possibly some might be bought at £14 15s. net per ton, filled into buyers' bags *ex* works, for 25 per cent. quality.

Tar Products in the Provinces.

Oct. 18.

Markets for tar products remain in about the same position. No business of importance is reported in pitch. Although some quantity

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MANCHESTER.

London Office:
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Old Broad St., E.C.

is offering in London at 20s. per ton, there are no buyers at this figure. Creosote is very quiet and difficult to sell. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 19s. 9d. to 23s. 9d. Pitch, East Coast, 19s. to 20s. per ton; Norfolk, Suffolk, and Humber ports, 18s. 6d. to 19s.; West Coast, 19s. to 20s. Manchester; 20s. to 21s. Liverpool; 20s. to 21s. Clyde. Benzol, 90 per cent., North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅞d. to 3d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 5d. to 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 85s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Oct.* 16.

Although the inquiry from abroad has remained on a limited scale, dealers in the United Kingdom have continued to compete keenly for all available supplies; and a further substantial rise in values has been recorded during the past week. The prices for prompt delivery are now £15 per ton f.o.b. Hull, £15 2s. 6d. f.o.b. Liverpool, and £15 5s. f.o.b. Leith. For future delivery, higher figures have also been paid, and it is reported that first-hand business has been done at the principal ports at £15 5s. per ton for November-December, and £15 10s. for January-March.

Nitrate of Soda.

The market for this material has advanced rapidly, and holders on spot now require 14s. 3d. per cwt. for ordinary, and 15s. 3d. for refined quality.

Sulphate of Ammonia.

From another source it is stated that the market for this article has remained fairly firm throughout the past week. Outside London, makes are quoted at £14; Hull, £14 10s.; Liverpool, £14 12s. 6d.; Middlesbrough, £14 10s. to £14 12s. 6d.; Leith, £14 15s.

◆

Bomb Damages a Gas-Main.—During the proceedings at an inquiry yesterday into the deaths of 23 victims (all in one district) of last Wednesday night's Zeppelin raid on London, a police inspector said one of the bombs dropped "made a hole 9 feet in diameter. One of the gas-mains was struck, and the fusing of electric wires caused a fire which took until five o'clock the next evening to put out, because the main had to be cut. But no real damage was caused, though the buildings all round were damaged."

COAL TRADE REPORT.

Northern Coal Trade.

There is a steady demand for coals, both for steam and gas qualities. For early supplies, there are firm prices; but forward deliveries vary more. In the steam coal trade, the demand is good for all but smalls. Best Northumbrians are from 19s. to 19s. 6d. per ton f.o.b.; second-class steams are about 16s 6d. per ton; and steam smalls are from 11s. 6d. to 14s. per ton f.o.b. More steam coal is being shipped—licences having been given more freely. Thus the output has been taken up well, though high freights to some extent interfere with business. In the gas coal trade, the demand increases steadily, and a good request for bunker coals helps to stiffen prices of other qualities of Durham fuel. Best Durham gas coals are 19s. per ton f.o.b.; second-class gas coal is about 16s. 6d. to 16s. 9d. per ton; and "Wear Specials" are 20s. to 20s. 6d. per ton f.o.b. Some sales are being made forward; but the high freights make values of delivered coal quoted very high. Gas coal from the Tyne to London is about 9s. 3d. freight, and to Rouen 18s. 6d. is quoted. The prospect, therefore, of freights for winter is not bright; but it needs to be added that the "coasting traders"—the interned steamers—are lower than the figures just given. At present it is worth note that the steamers are making more regular voyages than they were, so that the coal deliveries on the long contracts are fairly good. There is not much change in the coke trade; and, with a fuller production, stocks have increased in some directions. Good gas coke is from 29s. to 30s. f.o.b. in the Tyne. The home inquiry for gas coke is steady; but the exports have been rather lower from some ports.

◆

In connection with the Blackburn Corporation Gas Department, Mr. Thomas Hannibal, of the Secretary's department of the Smethwick gas undertaking, has been appointed Chief Clerk; Mr. C. W. Ward, of Retford, is to be Works Superintendent at the Greenbank works; Mr. E. Harrison, of Rochdale, has been appointed to take charge of the new gas show-rooms which are shortly to be opened; and Mr. J. H. Clegg, of the Aldershot Gas and Water Company, has been given the position of Chemist and Draughtsman.

A meeting of ratepayers of St. Columb last Wednesday confirmed the action of the District Council with regard to the public lighting. This was to terminate the contract with the Gas Company at the expiration of three months. The Company agreed for a term of three years to light the district for a specific sum; and the Council, consequent upon the receipt of a letter from the Local Government Board urging the practice of economy, asked the Company to extinguish the lamps at an earlier hour. The Company, however, replied that the provisional arrangement made with the Council was on the distinct understanding that there was to be no curtailment. The Council persisted, and then received notice from the Company to determine the contract at the expiration of three months.

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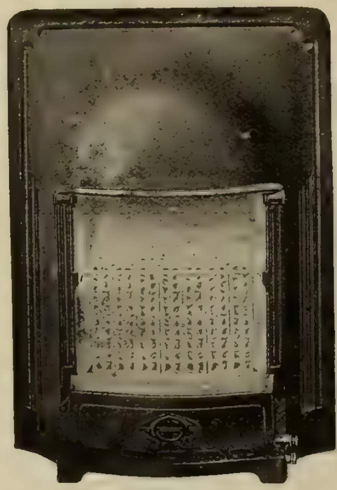

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Liverpool Water Supply.

Colonel Porter, in acknowledging a vote of thanks passed to him in s capacity as Chairman at the closing meeting of the Liverpool ater Committee for the municipal year, gave his customary brief reew of the work of the past twelve months, During the year, the tal quantity supplied from all sources was 14,464,575,000 gallons, an crease on the previous year of 343,961,000 gallons. The average te of consumption per day was 39,738,000 gallons. The quantity water supplied in the city and out-townships was 12,619,116,000 allons, an increase of 327,506,000 gallons on the previous year. There as an increase in the quantity of water supplied in bulk along the ivington and Vyrnwy aqueducts of 43,544,000 gallons. There was so an increase of 67,956,000 gallons in the consumption of water by eter for trade purposes, and in shipping supplies of 17,066,000 galons. In accordance with suggestions received from the President of e Board of Agriculture, arrangements had been made to reduce as r as possible the amount of land to be planted on the Vyrnwy area uring the season 1915-16. During the year 38 more officers and orkmen had left for military service, making the total number who ad joined the forces 119 out of 255 of military age in the department. addition to the men who had enlisted, there were several fitters and bourers from the water-works repair shops employed temporarily on unitions work.

◆

Westgate and Birchington Gas Assessment.—The Isle of Thanet ssessment Committee, at the beginning of this year, fixed the rateable alue of the Westgate and Birchington Gas Company's undertaking at 1568. The Company [for whom Messrs. W. A. Valon and Son act Engineers], however, objected, and succeeded in getting the figure educed to £750. Messrs. Ryde and Sons represented the Assessment ommittee.

Coal Contracts at Sowerby Bridge.—A subject which caused lively iscussion at the last meeting of the Sowerby Bridge Urban District ouncil was the question of coal prices. In committee it had been ecided to take advantage of the Coal Prices (Limitation) Act, and the lerk was instructed to notify the colliery owners of the fact. Mr. ongbottom pointed out that there was some doubt as to whether the ouncil would get a rebate on the coal now being delivered; the price er ton being higher than the figure mentioned in Parliament. They ad let their contracts at a high rate; and the new Act did not come to operation until Oct. 29. At the gas-works the Council had a huge ock of coal, for which they had paid an extraordinary price; and, nless the Act was made to apply to all the new season's contract, owerby Bridge was going to lose a lot of money. The Chairman of e Gas Committee (Mr. J. W. Whiteley) said they would have been olish if they had not got in a stock of coal. To have waited would ave meant running the risk of having the town in darkness. Their olicy was now to fight for a reduction in price for all their contracts; nd this probably will be the action taken by the Committee.

Failure of Electric Current in Birmingham—There was a stoppage of the whole of the tramway service of Birmingham last Tuesday evening, for a period of about half-an-hour, just about the time when the majority of workers were desirous of getting home. To some extent the lighting was also affected, though it did not altogether fail, The stoppage was attributed officially to a "combination of unforeseen circumstances;" two boilers having to be temporarily put out of action for cleaning, just at a time of excessively heavy demand for current.

Banwell Gas Company.—In a notice signed by the Secretary (Mr. J. H. Powell), it is intimated that, improvements and alterations at the Banwell Gas-Works having been completed, the Directors are able to offer an efficient supply of gas to every house situated in the district. Notwithstanding the heavy increase in costs of production, no advance in the price of gas is to take place—in fact, in certain circumstances a slight reduction is offered. To consumers purchasing or hiring gas cookers or fires, and using gas through ordinary meters, a special discount of 5 per cent. on their accounts will be given; and accounts due to the Company are now subject to 5 per cent. discount for cash, if paid before the last day of the month in which they are delivered.

Rockhampton Gas Company.—It was stated by the Chairman, Mr. R. C. Boland, at the half-yearly meeting of the Rockhampton (Queensland) Gas Company that the operations for the six months under review showed a profit of £3533, which, with the balance brought forward, made a total at credit of profit and loss of £6533, from which £1239 had been applied to writing-down the assets of the Company, leaving £5294 for distribution. Out of this the payment was recommended of a dividend of 9 per cent. per annum on the preference shares, and of 7 per cent. on the ordinary shares, which would leave £3500 to be carried forward. It was hoped that when the debentures were cleared off it would be possible to reduce the price of gas.

Mannesmann Tube Works under War Conditions.—According to "Engineering," the Mannesmann Tube Works in May last year effected a combine with the Schultz-Knaudt Plate-Rolling Mills; the capital at the same time being increased by 11,000,000 marks, so as to amount to 72,000,000 marks. While the Company had intended to pay a dividend of 13½ per cent. for the year 1913-14, they found it, on account of the war, expedient to reduce the dividend to 7½ per cent. The report for 1914-15 has now appeared; and it states that the Company to begin with suffered very materially from the effects of the war, and an improvement has only set in by degrees. Last November the Board were able to state that their production, which had fallen to 25 per cent. of the normal, had again risen so as to amount to 40 per cent. of the ordinary peace output. Matters have continued to mend; but although the Company also has profited by war contracts, full employment is not yet reached by a long way. The gross profits for last year amounted to 15,878,686 marks, against 16,804,197 marks for the preceding year; but the net profits were 8,120,004 marks, against 5,641,006 marks for the preceding year—the dividend being fixed at 10 per cent.

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A PERFECTLY SILENT BURNER,
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BIRMINGHAM.
LONDON SHOW-ROOMS:
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The "CHATSWORTH."

Fire at the Ash Road (Aldershot) Gas-Works.—A fire broke out early last Tuesday morning in the roof of the purifier-shed of the coal-gas section at the Ash Road works of the Aldershot Gas, Water, and District Lighting Company; the cause of it being at present unknown. Owing to the difficulty in obtaining communication with the fire brigade—the nearest alarms being more than half a mile away—the assistance of the brigade was unfortunately delayed; but, after arrival, the fire was soon controlled. The supply of gas to the public was not interrupted, nor the plant damaged to any serious extent.

Cost of the Burnley Water Scheme.—Some big figures were mentioned at a meeting of the Burnley Town Council, when it was decided to promote a Bill for the purpose of acquiring further borrowing powers in respect of the new reservoir at Hurstwood. Alderman Keighley said the work was originally let for £158,000; and it was anticipated that the scheme would be completed well within the parliamentary estimate of £215,000, for which borrowing powers were obtained. The original contractors, however, became bankrupt after the work had been three years in progress, by which time they had received £35,000 for work done. Fresh tenders were invited; but these were considered so high that the Water Committee decided to complete the undertaking themselves, under the charge of the Engineer. Up to the end of last July, the amount spent was £175,984; and it was estimated that it would require another £151,000 to finish the scheme. There had been an enormous rise in the price of labour and materials; and the site had disclosed many difficulties not anticipated.

Lighting of Sowerby Bridge.—A vigorous protest on the part of the public of Sowerby Bridge against the lighting restrictions which have been in operation for many months, has met with success; and at the last meeting of the District Council it was decided to completely change their policy. When the minutes of the Gas Committee came up for consideration, Mr. A. F. Longbottom took the opportunity to raise the lighting question. He said that, so far as he knew, there were no restrictions which now applied to Sowerby Bridge. During the past few weeks, complaints about the darkened streets had become very numerous. There were many dangerous corners in the town; and these ought to receive attention. The Council should pay better attention to the public requirements. The Chairman (Mr. John Bates, J.P.) was in favour of a return to full lighting throughout the area. It was a military order which compelled them to restrict street lighting; and this order had not been officially withdrawn. Subject to the approval of the military authorities, it was decided to return to the old lighting arrangements.

Halifax Walshaw Dean Reservoirs.—Members of the Halifax Town Council recently visited the Corporation reservoirs at Walshaw Dean, to celebrate the accomplishment of the task of making them watertight. The construction of the reservoir was begun in 1900, and completed six years later. Afterwards, however, it was found that, owing to faults in the strata, there were serious leakages of water, and remedial works were begun. Holes were bored in the embankment, and down these liquid concrete was pumped, in order to block-up the passages eroded by the escaping water. This method was applied on an unprecedented scale, and has proved entirely successful. The cost has been about £20,000, bringing the total expenditure on the reservoirs to some £380,000. Messrs. G. H. Hill and Son, of Manchester, have been the Engineers throughout. During an interval in the inspection, opportunity was taken to present a silver salver and tea service to Mr. Mark Crossley, in recognition of his valuable services as Chairman of the Water Committee for the past nine years. The Mayor (Alderman W. H. Ingham) made the presentation on behalf of the Council, and paid a high tribute to Mr. Crossley's work.

Wolverhampton Water Act and an Honorarium.—Presenting to the Town Council the report of the Parliamentary Sub-Committee on the Wolverhampton Corporation Water Act, 1915, Alderman Marston said the town had obtained valuable powers, and, in addition, an almost inexhaustible supply of water at a much lower cost than if they had purchased in bulk from Birmingham. Mr. Evans thought they could congratulate themselves upon the Act, which had been steered through Parliament notwithstanding a bitter, strenuous, and scathing opposition. Mr. Hughes said that he found himself antagonistic to the proposal relating to the payment of an honorarium of 350 guineas to Mr. E. A. V. Woodward, the Borough Water Engineer, who had, undoubtedly, rendered excellent service. He did not think the ratepayers would look with favour upon the payment of such a large sum, especially in view of the fact that all departments of the Corporation were studying the question of economy. Mr. Sharrocks said the Council had appointed an Economy Committee, and the time was inopportune for granting honorariums. Mr. Myatt, however, expressed the opinion that the honorarium was a payment for the overtime of an expert. The Mayor said he was in favour, not only of economy, but of efficiency; and he believed the Council would be well advised to accept the report unanimously. Mr. Woodward had rendered great service; and the new water supply would be an invaluable asset for the town's future generations. The report recommending the payment of the honorarium was passed by 24 votes to 8.

APPLICATIONS FOR LETTERS PATENT.

14,084.—Thompson, T., "Gas-stoves." Oct. 5.
14,125.—Hall, I., "Furnaces" Oct. 6.
14,142.—Waddell, A., "Manufacture of coal gas." Oct. 6.
14,143.—Waddell, A., "Gas-retorts." Oct. 6.
14,148.—Jones, F. G., "Gas water-heater." Oct. 6.
14,152.—Wilson, J. A., "Elimination of sulphur compounds from benzol." Oct. 6.
14,154.—Smith, F. G., "Gas-cookers." Oct. 6.
14,155.—Fuller, W. J. H., "Gas-lamps." Oct. 6.
14,180.—Bentley, J. E., "Gas-regulators." Oct. 7.
14,186.—Davey, H., "Gas-burners." Oct. 7.
14,273.—Hunt, E. J., and Gidden, W. T., "Treatment of sulphate liquors." Oct. 8.

Nautilus
Art in the Modern
Gas
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In addition to numerous successes already announced, The Nautilus Co. (owned by the Davis Gas Stove Co., Ltd.) have recently been entrusted with the Interior Decoration of the

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New Showroom
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Fatal Explosion at Beckton.—A message sent out at noon yester-lay by the Exchange Telegraph Company stated that an explosion iad occurred, at about 3 o'clock in the morning, at the Beckton works of the Gas Light and Coke Company. A sheet of flame was observed o shoot up in the air; and this was followed almost immediately by a errific explosion. Flames lit up the sky for miles around, and iundreds of people living in the vicinity of the works turned out of heir houses. So far as could be ascertained, only one man was killed, ind another slightly injured. The flames were quickly subdued by the Company's own firemen engaged at the works, before any considerable lamage had been done. Further particulars will be available at the nquest on the deceased man.

Mossley Gas-Workers' Wages Advanced.—Substantial advances n wages have been given to the employees at the Mossley Corporation Gas-Works. In March last an advance of 15 per cent. in the wages of ill men employed by the Corporation was asked for by the Municipal Employees' Association; and the Gas Workers and General Labourers' Jnion tendered a like request on behalf of the gas workers. At a neeting held recently between the Council Sub Committee and the Secretaries of the respective Unions, certain concessions were offered on the one hand and (with slight modifications) eventually accepted on he other. The concessions were equivalent to an all-round advance of 2s. per week to all men receiving less than £2 weekly, and ½d. per iour to all men employed by the hour. The new rates will take effect is soon as the terms of settlement have been approved of by the Council; and the Council will also be asked to agree to make the con-essions retrospective to July 8 last. At a meeting of the Council on Friday the recommendations of the Special Sub-Committee were ipproved. The advances in the Gas Department represent about £300 year.

Workmen's Compensation Act Appeal.—On Saturday, Mr. Henn Collins applied to the Court of Appeal [consisting of the Master of the Rolls and Lords Justices Bankes and Warrington] in the case of *Strange v. Davis Gas-Stove Company, Limited*, on behalf of the defendants, that plaintiff might be ordered to give security for the costs of an appeal, on the ground of want of means, and that her address was unknown. He said the workman met with a fatal accident; and the mother's case was that she had been living with some relations, to whom the son allowed 10s. a week. An award had been made in her favour of £100; she having claimed £156. The £100, and the taxed costs, were paid into Court; and though the money had been taken out, she proposed to appeal in respect of the £56. There was not much prospect of success. Their Lordships ordered appellant to give security for £10 within fourteen days.

Gas-Fires and Guards.—In the course of an inquest at Ashton-under-Lyne on Monday of last week, a point was raised as to whether gas-stoves should have fire-guards. It was an inquiry into the death of Amy Reynard (19), who died from burns received at the Corporation Fever Hospital, where she had been a fortnight as a probationary nurse. While attending to a child in the bath-room, her clothing came in contact with the gas-stove, and she died from her injuries. The matron said there was no guard on the stove, which was of modern pattern; and the possibility of danger had never occurred to her. The stove was only lighted at intervals. The Medical Officer of Health stated that gas-stoves were installed in the hospital in 1888; and there had never before been an accident. They were now being replaced by radiators. A Juryman asked whether the law did not make it necessary to have a guard on a gas-fire. The Coroner replied that he could not give an opinion. He had seen many gas-fires, but never remembered one with a guard. A verdict of "accidental death" was returned.

GAS COMPANIES IN THE STOCK EXCHANGE.

The state of things on the Stock Exchange which has prevailed for he last few weeks took a decided turn for the better last week. Busi-ess showed a gratifying tendency to develop something like moderate ctivity; and the tone at the same time was really cheerful. It would ave occasioned no surprise if the Bulgarian attack on Serbia and the esitation—if not absolute defection—of Greece had exercised a de-ressing effect upon markets in general. But they stood unmoved. Several, indeed, pursued the path of improvement which they were reading in the previous week. Government issues were conspicuous iere; and the War Loan steadily hardened and closed firm. Colonial ssues continued in demand. There were some good points in the Foreign Market, especially Japanese. German 3 per cents. were very lat—changing hands more than once at about a 6½ per cent. price. Home Rails were not supported. Canadian Pacifics made a good teady advance. South Africans were irregular; and so were Ameri-ans. In the Miscellaneous group, oil and rubber were fairly strong. Favourable reports of harvest prospects attracted attention to Argen-ina, Mexican affairs were regarded as more promising, and the same o a limited extent may be said of Brazil. The Finance Bill, circulated n Tuesday, of course, came in for criticism. Bankers protested trongly against being made collectors of income-tax on customers' eposits—so strongly, indeed, that the Chancellor of the Exchequer met their representatives on Thursday for discussion. Business in the Gas Market showed a decided turn for the better in point of activity, and the general tone was firm; some prices looking quite ready to advance if they could be encouraged by a little more animation being manifested. In the Money Market, the terms for short loans remained quite easy. Discount rates stiffened at first, but relaxed later.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 78, 78½, 78⅝, ditto preference 72½, 73, Imperial Continental 63¼, South Metropolitan 76¼, 76¾, 77. On Tuesday, European 12¼, 12⅝, 12¾, Gas Light ordinary 78, 78¼, 78½, Liverpool 93¾, South Metropolitan 76, 76½, 77, ditto debenture 60, 60½. On Wednesday, European 12⅝, Gas Light ordinary 77¾, 78, 78½, ditto maximum 60, 60½, ditto preference 72¾, 73, 73¼, Primitiva preference 3½, South Metropolitan 76½, 77, ditto debenture 59½. On Thursday, Commercial 80, European 12½, 12⅝, Gas Light ordinary 78, 78¼, 78½, Newcastle 84½, South Metropolitan 76½, 77, ditto debenture 60¼. On Friday, Brentford "B" 85, 85½, 86, Gas Light ordinary 78, 78½, ditto preference 72½, 73, ditto debenture 62¾, 63, 63¼, South Metropolitan 76¼, 76¾, 77, ditto debenture 60½, 61. On Saturday, Brentford "B" 85, 85½, 86, British 37¼, Gas Light ordinary 78, 78½, 79. South Metropolitan debenture 61.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING OCT. 16.

.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
			p.c.			£ s. d.	
368	Stk.	April 8	2½	Alliance & Dublin Ord.	59—64	3 18 2	..
000	,,	July 10	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
000	5	April 29	7½	Bombay, Ltd. . . .	5⅞—6⅜	5 17 8	..
000	10	Feb. 26	10	Bournemouth Gas and Water 10 p.c. . .	29—30	5 6 8	..
480	10	,,	7	Do. B 7 p.c. .	15—15½	4 10 4	..
000	10	,,	6	Do. Pref. 6 p.c.	13½—14	4 5 9	..
	—	—	—	Do. Deb. . .	..	—	..
000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	5 5 8	..
000	,,	,,	11	Do. New . . .	204—209	5 5 8	85—86
000	,,	,,	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
250	,,	June 11	4	Do. 4 p.c. Deb. .	91—93	4 6 0	..
380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	5 3 4	..
200	,,	,,	8	Do. A Ord. Stk. .	154—159	5 0 8	..
000	20	Mar. 26	12½	British	44—45	5 11 1	37¼
000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
000	10	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
000	10	—	—	Do. 4½ p.c. Pref. .	4—6	—	..
000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
150	Stk.	Feb. 26	5	Chester 5 p.c. Ord. . .	108—110	4 10 11	..
280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	5 1 2	80
000	,,	,,	5½	Do. 3½ p.c. do. .	103—105	5 1 6	..
000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
000	Stk.	,,	4	Continental Union, Ltd.	76—79	5 1 3	..
000	,,	,,	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
	—	—	—	Croydon B and C 7 p.c.	..	—	..
270	Stk.	—	6	Derby Con. Stk. . . .	123—125	4 16 0	..
000	,,	—	4	Do. Deb. Stk. .	102—104	3 16 11	..
180	10	July 29	10	European, Ltd. . . .	17½—18	5 11 1	12¼—12¾
910	Stk.	Feb. 12	4/17/4	Gas Light and Coke 4 p.c. Ord. . .	98—102	4 15 6	77¾—79
000	,,	,,	3½	Do. 3½ p.c. max. .	76—79	4 8 7	60—60½
235	,,	,,	4	Do. 4 p.c. Con. Pref.	96—99	4 0 10	72½—73¼
850	,,	June 11	3	Do. 3 p.c. Con. Deb.	72½—74½	4 0 6	62¾—63¼
000	,,	,,	10	Do. 10 p.c. Bonds .	..	—	..
740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
000	10	April 29	11	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
	—	—	—	Hornsey 7 p.c. . . .	..	—	..
000	Stk.	Mar. 12	7⅞	Ilford A and C . . .	151—154	5 2 4	..
740	,,	,,	6⅜	Do. B	115—118	5 8 0	..
500	,,	June 26	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
000	Stk.	May 14	9	Imperial Continental .	150—160	5 12 6	63½
000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
000	Stk.	Feb. 26	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	93¾
100	,,	,,	7	Do. B	146—14	4 14 7	
088	,,	June 26	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d	
75,000	5	June 11	6	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	Monte Video, Ltd. . .	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	84½
529,705	Stk.	June 26	3½	Do 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	Oriental, Ltd. . . .	117—122	6 11 2	..
60,000	5	Mar. 26	10	Ottoman, Ltd. . . .	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	Portsea, Island B . .	128—131	4 19 3	..
100,000	50	,,	12	Do. C . .	118—121	4 19 2	..
52,000	50	,,	10	Do. D . .	..	—	..
249,980	5	April 29	8	Primitiva Ord. . . .	5½—6	6 13 4	..
499,960	5	June 26	5	,, 5 p.c. Pref. .	4¾—5	5 0 0	3½
521,600	100	June 2	4	,, 4 p.c. Deb. .	91—93	4 6 0	..
—	—	—	—	,, ,, ,, 1911	..	—	..
846,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	San Paulo 6 p.c. Pref	10½—11	5 9 1	..
125,000	50	July 1	5	San Paulo 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk	Mar. 12	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	Do. B	222—224	4 9 3	..
523,500	,,	,,	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	South African . . .	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	South Met., 4 p.c. Ord.	111—113	4 16 8	76—77
1,895,445	,,	July 10	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	59½—61
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	,,	,,	5	Do. 5 p.c. Pref. .	110—112	4 9 3	..
—	—	—	—	Do. West Kent. .	..	—	..
187,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	Tottenham District A 5 p.c. .	135—138	5 8 8	..
742,275	,,	,,	6	Do. B 3½ p.c. .	115—117	5 2 7	..
181,255	,,	June 26	4	Do. 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	5 5 8	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
				Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅝	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅞	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	,, C 3½ p.c.	110—115	5 2 0	..
852,000	,,	,,	6½	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	,,	,,	6⅝	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	,,	June 26	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

The Anglo-Romano Gas Company announce that it has been decided, as a precautionary measure, in view of the continuance of the abnormal state of affairs, not to pay an interim dividend against Coupon No. 9.

Flooding of streets and houses, and interference with the tramway service in Aston, resulted from a water-main burst on Monday of last week. The main in question, a 30-inch one, was that running from Whitacre to Birmingham.

The new season's fire booklet of the Parkinson Stove Company, Limited, of Birmingham [which is provided with an artistic coloured wrapper], gives, with a number of well-known designs of the firm, illustrations and particulars of a new series of fires, introduced in order to meet the demand for apparatus to suit the modern style of furnishing and decoration. These combine with a handsome appearance all the latest improvements in fire construction introduced by the Company.

In a booklet, with a coloured wrapper eminently appropriate to the title of "For Hearth and Home," Messrs. Fletcher, Russell, and Co., Limited, of Warrington, illustrate and describe briefly their numerous patterns of modern gas fires and geysers; a supplement being devoted to the new "Classic" series of fires, designed to harmonize with decorations and furnishings in historic styles. The patterns included in this "Classic" series, which are for recessed fireplaces, were favourably commented upon in an illustrated article appearing in the "JOURNAL" for Sept. 14, p. 570. A separate booklet is available dealing with the firm's radiators.

The Sheffield University have decided to conduct scientific research in connection with the glass-making industry, and to conduct classes, so as to enable this country to capture those branches of the trade which have hitherto been left to Austria and Germany.

A series of leaflets have been prepared by Messrs. Goodall, Clayton, and Co., of Leeds, furnishing particulars regarding the working of various installations on the "Intermittent" vertical retort system, constructed by them under licence from the Vertical Gas-Retort Syndicate, Limited. The information will prove useful to gas engineers.

A copy is to hand from the Pneumatic Gas Lighting Company, Limited, Farringdon Street, E.C., of the illustrated catalogue for the season 1915-16 of the pneumatic distance gas lighter, with accessories. The Company's specialities are so well known in the industry that it is unnecessary here to allude to them in detail; but, as an indication of their popularity, it may be mentioned that the present catalogue is a much larger one than has been issued in previous years.

Notices have been issued by the Barrow-in-Furness Corporation calling attention to the critical position which has arisen owing to the depletion of the reservoirs. To convince the public of the state of affairs, Mr. F. Chadderton (the Gas and Water Works Manager) has had photographs of the Harlock reservoir prepared for distribution. The reservoir in normal times contains 226 million gallons; and lately no water could be drawn from it. The trouble has been caused by the persistent drought, which also had its effect in many other towns, and by an abnormal drain on the resources for industrial purposes.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ASSISTANT SUPERINTENDENT. No. 6105.
TESTERS (Gas-Fires, &c.). No. 6107.
GAS RENTAL CLERK. Smethwick Gas Department. No. 6109.

Appointments Vacant, &c., (*continued*).

WORKS FOREMAN. Grantham Gas-Works.
WORKS FITTER AND TURNER. No. 6110.
FITTERS. No. 6106.
BLACKSMITH. Aldershot Gas, Water, and District Lighting Company.

Process Wanted.

NAPHTHALENE SEPARATION AND REFINING. No. 6104.

TENDERS FOR

Fire-Clay Goods.

SHEFFIELD GASLIGHT COMPANY. Tenders by Nov. 2.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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VOL. CXXXII., No. 2737.] TUESDAY, OCTOBER 26, 1915. [67TH YEAR.

EDITORIAL NOTES.

Toluol Production—The Naphthalene Question.

UCH interest has been evinced in the editorial article in st week's issue in which all who have influence in the atter were urged to work with the view of securing the aximum yield of toluol—urged because there is no question to the necessity and the exigency. The article, we hear, s already acted as a stimulus; and there is assurance that will assist in promoting a healthy rivalry in doing the best ssible for the country in this regard. There are isolated ses—thank goodness they are isolated—in which even the atter of the extraction of toluol from gas has been put to the balance as a business proposition, to ascertain the eight of the relative credits and debits so as to see whe- er there is a substantial margin to justify compliance with e requirement. What is thought of those directing such dertakings is not in their favour. The gas industry is not philanthropic institution. It is an industry carried on with motive ulterior to the securing of a fair return on the pital invested, of some reward for enterprise, and of an cretion of strength and power through the development interests, processes, and services. But the general feel- g in the industry is one of gratification that it is its good rtune to be in the position to assist the country in an ceptional manner in an extreme and unparalleled crisis. hile it is only right that the industry shall not financially ffer through this, such a consideration is, with a majority men in the industry, the last thing to be thought of as niting what is both a duty and a privilege. The response duty and to privilege must have ascendancy over all else ien every drop of toluol that can be produced is of value the country, even though the procuring of it brings in its in some slight, but not irremediable, inconvenience.

The article in last week's issue has brought to us some ivate letters and personal communications. It is a plea- re to hear of instructions having been given to see that thing is left undone to realize the best possible returns, and try and exceed the past returns from the works. This the spirit that the article was intended to engender; and such spirit operates in every case, the object will have en served. There was appeal in the article to the smaller orks to do their part. Among communications is informa- n which shows that a number of small works had already sponded to the prior appeal. They are doing their "bit." e were aware of it. But there are a not inconsiderable mber that are not. There is a recruiting poster on our ural surroundings with the smiling face of a "Tommy" on and the words underneath: "He is doing his bit, and is atisfied. Are you?" The words may be adopted for plication in connection with the work on toluol. One cor- spondent says that some very small gas-works are being essed to adopt the "C" process, although there is not the ghtest chance of this being done with the plant at disposal, d although there is only a working foreman to look after

In some small works in the country, the ammonia re- rns would be in normal times all the better for an addition the scrubbing plant now, when toluol is such a pressing sential, in enormous quantity, through the tremendous urly expenditure in the various theatres of war. As to e working foreman and supervision, there is no question at supervision is needed for the process. But, given fficient scrubbing plant, where there is the will, there can found a way. Most of the small works are under the pervision for general working of an engineer of a larger orks not far distant; and where they are not, it would not an unpatriotic act for some competent person from a ger works to make a periodical inspecting tour to neigh- uring small works, and render closer help and more im- ediate advice than is possible by those who are officially gaged in "visiting" work over large areas.

One complaint made, in the name of the smaller works, is that it is not very encouraging to them to find that certain large works are not doing all they might do with their greater facilities in output, plant, and staff. The Bristol Gas-Works are instanced; and a correspondent says that, according to his information, toluol is only being extracted there at one out of three works. We hope he has been misinformed, or, if accurate, that there is an explanation. We shall, however, be glad to hear from the Company, and to publish a statement to the effect that a mistake has been made, or that the process is now being applied to a larger extent. The "statement" being in circulation, should "mis" be prefixed to the word, it will be an advantage to have it corrected. The correspondent adds that the exercise by the Bristol Company of their full capacity for producing toluol would equal the possible production of a very large number of small works. But because a large concern is not working up to its full capacity is no reason why the small undertakings, with plant available, should not be doing their little part. It only makes things so much worse if they are not doing it; and, be it remembered, we have high authority for stating that every drop of toluol procurable is wanted. This being the case, those who can contribute more, but will not put themselves out a little to do so, are doing something to serve the enemy. That is the plain truth.

In view of the imperative need of the country, any little additional trouble that may arise must be regarded as a subsidiary matter. There has been with the advent of colder weather, difficulty somewhat above the normal with naphthalene in various areas; but this must not be allowed to be a deterrent to the realization of the fullest possible supply of toluol. The "C" process reduces the number of grains of naphthalene per 100 cubic feet of gas; but this reduction notwithstanding, with the colder weather, there is the extra difficulty, probably owing to the larger percentage of light oils extracted from the gas by the process, leaving insufficient to hold the naphthalene in suspension. In the article on the "Market Value of Light Oils and Other "Constituents of Tar" that appeared in the "JOURNAL" for July 20, it was shown that the benzol, toluene, solvent naphtha, and heavy naphtha in a sample of crude tar from Durham coal totalled 3·4 gallons per 100 gallons, while in a sample of "treated" tar from Durham coal the same constituents amounted to 9·4 gallons per 100 gallons. There is sufficient explanation here to account for an accentuation just now of the naphthalene trouble. However, experiences vary among engineers working the process at normal temperature; for some assert that they have not yet experienced what others say they are experiencing acutely, or in rather more than usual degree at this time of the year. However, it seems that, in some instances, there is likely to be a return temporarily to one or other of the processes that were applied, to obtain relief from naphthalene trouble, before heavy charges in horizontal retort and vertical retort working produced some reduction, and so lessened the necessity for the application of these processes. The main thing is that toluol is a vital national essential to-day, and as long as the war lasts.

A Strong Backing.

OF special interest and opportuneness are two aspects of the short address that Bailie Paxton, of Glasgow, delivered as President of the British Commercial Gas Association last Tuesday. The one was not verbally presented—the other was; and it supplies a tersely put, but irrefragable, case for financial support, on the full regulation scale, being given to the organization. But first concerning the aspect of the address that has no direct expression. The mouthpieces of the gas industry in connection with its work have been for the most part its executive officers; and practically all the executive officers—those upon whom fall, in large measure, the responsibility for business development and dividend and interest earning—are men who do not need conversion to the aims, objects, and methods of the Association. The administrators of gas undertakings, who hold the purse-strings, are fully cognizant of this; and we fancy that some of them rather incline to the view that members of the gas profession in this matter of co-operative effort simply run together like a flock of sheep. Those who may entertain this view have little real understanding of all that co-operative publicity and educative propaganda mean to the gas industry. But here we have Bailie Paxton—typical of all that is strong in the commercial world, and one who for many years was at the head of the Gas Committee of the Glasgow Corporation. He is not a gas engineer or manager; he is purely a virile man of business, and does not claim to be anything else. This being so, his views should appeal strongly to other gas administrators; and his views regarding the work of the British Commercial Gas Association are crystallized in the words—it is indispensable. Things that are indispensable forge ahead in acceptance without requiring much motive force behind. With him, as other gas administrators will see, the indispensableness amounts to a deeply rooted conviction; and so great is his faith, that he is satisfied that not many years will pass before the (under) 20 per cent. by volume of gas sales unrepresented in the Association will be added to the present (rather above) 80 per cent. that subscribe to the work of the Association, and the expenditure be looked upon as being as necessay as that for coal or wages.

Bailie Paxton, as a business man and gas administrator, does not stand alone in his views on this subject. In his address—and this is the expressed aspect—he presents such a phalanx of considered opinion backing his views that those gas administrators who do not appreciate the value of the work of the Association, or prefer that others should pay for it although enjoying the increased stability it is giving to their interests, would, if they were disposed to try, find it an impossibility to break through that phalanx. When the gas administrators of London, Edinburgh, Cardiff, Dublin, Glasgow, Manchester, Salford, Birmingham, Liverpool, Belfast, Newcastle, Bradford, Leeds, Sheffield, Hull, Derby, Leicester, Norwich, Portsmouth, and Plymouth give their support, with those of many other substantial gas supply concerns (not forgetting the Society of British Gas Industries), to the work of the Association—knowing it to be good—what can those outstanding say in any attempt to show that they are right in declining to support the co operative work, and that the administrators of the imposing concerns mentioned are all wrong in doing so? It would be a very real pleasure to discuss the matter with those who believe that all the administrators of those gas undertakings have gone astray in this regard.

Up to now, says Bailie Paxton, nearly £100,000 has been subscribed and spent upon co-operative publicity work for the gas industry; and every undertaking in the country—subscribing and non-subscribing—has benefited from it. It is no use simply to deny this; it is no use postulating that even traces of it are not to be found in the balance-sheet. This depends upon the amount of acumen brought to bear on the examination of the conditions and of the balance-sheet. Before the Association came into being, what was being done beyond ordinary local effort to develop the gas business? Nothing. But since, the Association has exercised a potential educative influence in many quarters where the individual gas undertaking could not have entered and operated; and the gas industry is feeling the effect of the influence. We are sensible everywhere we go, and day by day the feeling is being strengthened, that ill-conceived prejudices and misapprehensions have been, and are still being, removed; and that gas, and all that the industry is in and to the work and convenience of the nation, are better appreciated than ever before. This change, which is growing, is not due to the disjointed policy preceding the advent of the Association. It is due to well-defined effort and set purpose; and it is a certainty that the position of gas supply and application would not be altogether what it is to-day had it not been for the work of the organization. The work is a gain; it has reinforced the position of the gas industry. A bomb fell the other night on a reinforced concrete roof in London. The roof withstood the shock. A bomb the same night fell on to a wood-paved thoroughfare with a concrete foundation. The concrete foundation at the spot was pulverized. The gas industry has a strong, cleverly directed competitor. The British Commercial Gas Association has added, through its reinforcing work, to the power of resistance of the gas industry, and to its capacity for making progress. We ask the outstanding undertakings—large and small and the intervening ones—to think over the matter in this light; to think of the position before the advent of the Association, to think of the position as it is now, and ask whether the stability of the industry would be what it is, and its future so solidly assured, without the unflagging work of the Association. Those—if any there be—who say they would have been, must be blind to the most patent facts.

The Juniors Start a New Session.

The Junior Associations have commenced their session's work in Scotland and in London; the Midland juniors will be meeting next month; we have yet to learn what the Yorkshire Association are proposing to do; but the Manchester Association have, for sufficient reasons, decided to abandon their meetings this winter. There can be argument both ways as to whether continuance or discontinuance of the meetings is, under current circumstances, the proper course. There is so much to be done for the local community and the country generally inside and outside gas-works by men of military age (and most members of junior organizations are so), and there has been such a considerable drain upon the staff and rank-and-file of almost every gas undertaking, that there cannot be much remnant time to be devoted to meetings away from home. At the same time, there is sympathy with the view, as expressed by the President of the Western District of the Scottish Junior Gas Association last Saturday (Mr. David Fulton, now Engineer and Manager at Helensburgh), that "those members whose path of duty lay at home would be glad of an opportunity of occasionally meeting in the usual way. Therefore, a somewhat restricted session was arranged." There is little question that for some gas undertakings the coming winter will be weighted with considerable difficulty in respect of both raw material and the maximum demand for labour. But, if the former, it will be largely the fault of the administrations; for most works have lately been in the position to secure good stocks—and they will want them before the winter months are left behind. Naturally, during times of stress and difficulty, there is advantage in men of the same calling getting together to talk over affairs, for experiences often lead to mutual relief and other benefit. The argument is therefore about equally balanced in favour of meetings or otherwise this next winter. Of course, the same arguments apply to the senior organizations.

In last week's issue some extracts were published from the address of the President of the Eastern District of the Scottish Juniors (Mr. J. J. Scott); and this week there are addresses by Mr. S. B. Chandler, President of the London and Southern District, and by Mr. Fulton, already alluded to. All three Presidents speak in unison of the value of the Junior organizations to themselves and to the industry. We do not know of any movement in the industry that has done so much as these junior organizations to put the juniors on their mettle, to promote among them perseverance in inquiry, to discipline their minds in regard to technical matters, and to bring into the light of day the best there is in them. They provide fertile grounds in opportunity and incentive; and when Mr. Fulton remarks, "Whatever slight success I have achieved has been in no small measure due to the educative and inspiring influence of this Association," he is only saying what he and scores of other young men of that and other junior organizations know to be true. Every year brings its fresh proof of value; and every year adds to our pleasure over the part we took—subsequent to the establishing of the Manchester Association—in stimulating the organization of the juniors. The Associations have done much to fit the juniors for work in higher spheres.

But there is still a feeling among the juniors that all possible is not being systematically done that might be done for preparing them for their work in later life. We get this voiced by Mr. Fulton; and it is an echo of the capital feature of the address on "Education in the Gas Industry" that Mr. F. J. Bywater delivered at the Midland Junior meeting in February, 1914. Mr. Bywater spoke, and Mr. Fulton speaks, from personal experience, when deploring that there is non-existent in the gas industry a scheme defining the lines on which the education of the technical juniors should proceed. They are, outside the practical experience within the gas-works, left very much to follow their own devices and inclinations in the matter. As we said at the time Mr. Bywater delivered his address, we are not believers in cast-iron educational formulary for men of diverse intelcts, though training for the same profession. But, as Mr. ulton observes, we have the educational machinery at hand r the technical gas student; and it is a great pity that the st use is not made of this by the preparation by a compe- nt body of something directive for the gas student as to e course of study he should pursue. This is a work that uld very well be taken in hand by the Institution of Gas ngineers in collaboration with the Universities, colleges of ience, and technical schools at which there are depart- ents specially devoted to lines of scientific study that bear ndamentally upon the engineering work and processes of e gas industry. When from those who have been closely entified with the junior organizations, and have passed to nior estate, there comes an appeal of this character, it ought ot to be placed on one side—and forgotten.

Commercial Position and Essentials.

HE address (mentioned in the preceding article) that Mr. handler delivered at the meeting of the London Juniors on riday was full of good things, taking, as it did, a sweep- g glance over the commercial position of the industry in lation to gas sales and applications, and in competition ith the electrical industry. The position is good, provided aintenance is properly and liberally studied, and provided at the gas-fitters employed are raised to a proper state efficiency for their work. Mr. Chandler points out, among uch else, how the present war has accentuated the large d influential capacity for work of the gas industry in divers rections, in comparison with which the capacity of the ectrical industry has a restricted actuality. There is rdly anything—in fact, we do not know of anything—that n properly be called war material in the production of hich the gas industry has not had part, or for which (and ese vital necessaries) it has not assisted in the provision the basic ingredients. The position is one of which the dustry is pardonably proud. In some respects its ability be of such vast use to the nation in these times is due to e scientific handling of the coal it uses, compared with the ery unscientific methods employed at the very root of elec- icity generation. Mr. Chandler calls attention to the value btained per ton of coal carbonized by the gas industry and the enormous waste that proceeds hour by hour in the lectric industry through the charging of raw coal instead coke under its steam-raising plant. Supplementing what e said, the two processes may be examined upon thermal sults alone. Before the war certain electricity stations ere paying an average of 15s. 9d. per ton of coal delivered; nd the fuel accounts worked out to 0·44d. per unit of elec- icity generated. This meant 429 units per ton of coal, hich, at 3420 B.Th.U. per unit, would develop a total of ,467,180 B.Th.U. Take a production of only 12,000 cubic et of gas per ton of coal, and 520 B.Th.U. per cubic foot, is means 6,240,000 B.Th.U. Take roundly 10 cwt. of oke per ton of coal carbonized, and 13,500 B.Th.U. per lb., e 10 cwt. of coke would develop 15,120,000 B.Th.U. Thus as and coke alone (without reckoning the tar and pitch) om a ton of coal give us on a low estimate 21,360,000 .Th.U., as against 1,467,180 B.Th.U. by the electricity enerated from a ton of coal, under the conditions men- oned. Thermally, and in the destruction of valuable pro- ucts, the electrical process is terribly wasteful. It is a atter of which Professor W. A. Bone and the newly formed ritish Association Committee on Fuel Economy should ake note.

With all that Mr. Chandler had to say respecting modern as appliances, and the excellent position in which their fficiency places the gas industry, we are in full accord. he same with respect to his remarks on the education of as-fitters, and the necessity for gas salesmen being well cquainted with the principal competitor and with electric ppliances. There is one small point for criticism. We ant to put as favourable a view upon our position as is ustified, but not more so. Mr. Chandler says it is not easy imagine the time when electricity can ever successfully ompete with gas for certain purposes, especially when one onsiders that, in respect of thermal units generated, about cubic feet of average town gas are the equivalent of he expenditure of a Board of Trade unit. From this, he emarks, it appears that current must be supplied at some- hing like ¼d. per unit to compete with gas in point of cost lone. It is not exactly so. Mr. Chandler takes no account f the respective efficiencies of the appliances. He obviously ssumes that the B.Th.U. of the 7 cubic feet of gas and the unit of electricity are all going to be converted into useful work, which they will not be. The proportion of B.Th.U. so converted depends upon the efficiency of the appliances used for different purposes; and efficiency affects cost.

In the matter of the practical training of members of the outdoor staff, the suggestion appeals to us as an excellent one that on every works a permanent exhibition should be established (open to employees only), in which a sample of every piece of apparatus adopted for sale or hire should be placed; and periodically the parts, operation, and capabilities of the appliances should be explained to the staff and the men by a competent official. This would be educative, and therefore valuable in realizing a progressive efficiency. And nothing should be left undone to attain this in the highest possible degree. Taking a perspective view of conditions, it is safe to say that competition will become more active and more severe with passing time; and therefore the industry must betimes organize and develop its resources to the finest attainable pitch. It has good appliances; it dispenses in the majority of places cheap B.Th.U. The position must not be spoilt by the inferior work and knowledge of indifferent men. Mr. Chandler has very broad views on the essentials; and those who adopt and practise the lines laid down in the address will be those who will give a good account of themselves in the gas-trading work of the industry.

Coal Supplies and the Winter.

Many gas undertakings have protected themselves and their patrons by putting into stock for the coming winter an unusually large quantity of coal. They have been wise; for exactly what is going to happen in connection with both coal output and transport during the next few months is as nebulous as anything can be. Recruiting still proceeds in the mining areas and among railway staffs; and it is considered that, unless a stop is put to this, the two services will be grievously imperilled. There is also the insecurity of sea transport, and the shortening of the hours of running during a day. On the whole, it is clear the next few months will be full of uncertainties. In their market report last week, the "Iron and Coal Trades Review" said that "the output of coal at the present time is certainly not equal to the home and foreign demand." If this is so, then it should mean a further curtailing of the quantity allowed to be exported. In the House of Commons last July, Mr. Russell Rea, the Chairman of the Coal Exports (Regulation) Committee, stated that the principle guiding the Committee is "the Englishman first, the foreigner second," with, of course, special consideration for our Allies. The work of the Committee therefore is to see not that the output is equal to demand at home and abroad, but that there is primarily satisfaction of home requirements.

A German Gas-Works Report.

Unusual interest attaches to the report for 1914 of the German Continental Gas Company, of Dessau, because, of course, it covers several months during which the countries in which the operations are conducted were at war; and, moreover, it offers some few remarks with reference to the progress of affairs within so much of the present year as has already elapsed. The issue of the accounts is somewhat belated; but those who are familiar with the operations carried on by the Company will understand, as is pointed out in the report, that there has been delay owing to the difficulty of obtaining early information of the position of the Company's undertakings in hostile countries. Now that the figures are available, they show a falling off in the total output of gas from the different works of less than 1 per cent.; and this reduction, it is stated, is entirely due to the altered condition of affairs prevailing in the period which succeeded the fateful first days of August. This early adverse effect, it seems, subsequently vanished, for the scarcity of petroleum as a result of the war was responsible for the bringing in of many new gas consumers; and there would have been more but for the lack of labour, which interfered with the making of connections. One of the Company's stations with regard to which direct information was wanting at the time of the report was Odessa; but the past months have at any rate been less eventful there than has been the case at Warsaw, which works were sequestrated at the end of the year by order of the Russian military authorities—only to be restored by the German Government during the latter half of August.

Whatever may have been the effect of the change of ownership on the gas manufacturing operations, the works themselves were in good condition when the Company recovered control of them. That the position of the electrical industry in Germany is not a happy one is confirmed by the statement in the report that the embargo placed on copper has hindered the further extension of the Company's electrical undertakings.

Jealousy and a "Phenomenal" Demand.

The little exhibition lately held at the Hygienic Institute in Devonshire Street (off the famous Harley Street) has excited the envy of "Electrical Industries;" and it has been pouring out green jealousy by the column. It praises the thorough work that is being done by the British Commercial Gas Association, and wants to know how long the electrical industry is going to let the gas industry have all its own way in the matter of co-operative propaganda. But for the rest, envy, malice, and all uncharitableness The Sales Manager of the Marylebone Electricity Department (Mr. H. H. Holmes), of whom we have not heard for some time, appears to have regarded the torrential outburst of our contemporary as reflecting upon the enterprise of his department. Mr. Holmes is mournful. The financial conditions of the formerly boastful Marylebone Electricity Department are not such as to promote joyful feelings. "We could not help ourselves" is the burden of his song. In current circumstances, the Council will not do anything fresh in the way of advertising. There has been such a drop in revenue that there is no money to spare for advertising. The reserve fund has already been greatly depleted. Had conditions permitted a display at the Hygienic Institute, it would have been inadvisable; for, without advertising, the demand for electric cooking and heating apparatus in the Marylebone area is "phenomenal." We should like to see the word "phenomenal" translated into numbers and types of apparatus. Things are so bad, indeed, financially that it is quite possible the department will have to cease the hiring of apparatus, seeing that they have nothing in the locker, and loans for electrical apparatus are something that cannot be contemplated, as being for the purpose of pandering to the desire of the idle rich for novelty, and of supplying installations to those whose enthusiasm or interest surpasses discretion and need for economy in money and time.

The State of Employment.

The prevalence of a condition of affairs which has for some time past been manifest to employers, is demonstrated by official figures with regard to the state of employment at the beginning of this month. From these it appears that in the trades compulsorily insured against unemployment, the percentage of those not in work on the 1st inst. was only 0·91. This is a slight further decrease on the figure of a month earlier, and compares with 5·11 per cent. at the same date in 1914, and 3·45 per cent. two years ago. That is to say, over the whole of the United Kingdom the rate of unemployment in the insured trades is less than one-fifth of what it was a year ago, and under one-third of the rate in 1913. With reference to the various uninsured trades, the number of men and women on the registers of the Labour Exchanges on the 1st inst. shows some increase on the figure of a month ago—the exact total being 64,226, compared with 61,767. For the larger aggregate this month, however, female labour is entirely responsible; the figure in the case of men having remained practically stationary—at 16,962, against 16,950. From this it will be seen that, among the uninsured trades, the number of women on the Labour Exchange registers was at the beginning of this month nearly three times as large as that of the men.

Factory Lighting and Night Work.

We have lately had before us the first report of the Departmental Committee on the Lighting of Factories and Workshops, and have discussed some of the information and conclusions contained in it. The report supplies the case for good lighting in places where manufactures are carried on being of considerable economic advantage. Good artificial lighting means, apart from protection from accident, greater output and better quality. This being so, the report is very opportune, as there has been no time in modern history when the maximum output of the best quality has been required from many of the factories and workshops of the United Kingdom—that is to say, from those engaged in an way in providing material for the war. Numerous factories are now working far into the night; some are working all night. In the case of the latter, at the present time at least thirteen hours artificial illumination daily are required, and more than this as the shorter days and longer nights come along. It is imperative, therefore, in the interests of the country, that the artificial lighting of factories and workshops shall be brought up to the highest requisite standard; and in this work the outdoor departments of gas undertakings should try to make their influence felt. It is a work that will have beneficial result for the manufacturer, the country, and the gas undertaking. With such a distribution of effect, there can be no charge of purely selfish motives on the part of gas undertakings in moving in the matter, especially armed as they are now with the report of the Departmental Committee There is another matter in which advice can well be given to factory owners. Factories, as a whole, have large side, and in some cases top, window areas; more artificial light is required at night time; and orders for the subduing of external illumination from internal light sources, so as not to assist night air raiders, have come along. The conditions and the orders are hostile. But the orders must be obeyed; and at the same time production must be maintained at the maximum by the aid of good lighting. The subduing must be effected by methods that do not interfere with the natural lighting; and so the sales departments of gas undertakings should, in addition to providing a good supply of artificial light, make a point of studying the best means of modifying the emission from factory windows of light after dusk. The two things go together.

Canadian Calorific Standard.

The gas men of Canada are well satisfied with the universal calorific standard which has superseded the illuminating power one throughout the Dominion. This places Canada in a leading position in regard to a change which the new circumstances of the gas industry mark as sensible. The conditions in connection with the new standard were set forth in our issue for Sept. 7, on which occasion, in editorial comment, we had nothing but congratulation to express, save a criticism or two in respect of details The matter was referred to in the report of the Executive Committee and in the address of the President (Mr. H. E. Mann, of Montreal), at the annual convention of the Canadian Association last month. It transpires that the new gas-testing regulations were framed by the chief officials of the Inland Revenue Department, in collaboration with the Executive Committee of the Association, which was the correct mode of procedure to arrive at a satisfactory result. The Executive Committee look upon the success that has attended the work as being highly important to the industry; and the President said "the perpetuation of the candle-power standard was detrimental to the advancement of our industry." If the gas men of this country would take the same broad view, and could only get the Board of Trade to see things in the same light as the Canadian Government Department concerned in the matter, we should soon have a catholic calorific standard for gas supply in the Mother Country. Our legislators agree that calorific power is the proper standard. They even now counsel it when promoters of Bills are in Parliament. They would save themselves and the gas industry a lot of trouble if they would only do the same as has been done in Canada, in putting universality upon the new standard. There the new standard of 520 B.Th.U. (total heat test) is to apply to all manufactured gas—whether from British Columbian coal in the west, from Nova Scotia coal in the east, or from Pennsylvania coal in Central Canada. Water-gas manufactured from coal or coke and oil is to similarly conform. If the new standard proves irksome to any undertaking by reason of geographical location or quality of raw materials available, the Executive Committee of the Association ask that the matter be reported to them.

Patents and the Defence of the Realm.

Inventors in certain branches which are sure to be appealing to many creative minds at the present time will do well to take note of a recent Order in Council which confers additional powers, under the Defence of the Realm Act, on the Comptroller-General of Patents; though it is clearly stipulated that, before exercising any of these powers, the Comptroller-General shall consult with the Admiralty and Army Council, upon whose request only shall he act. The object of the Order is, first, to enable the Comptroller o delay proceedings in connection with any patent applied for n the United Kingdom the publication of which it may be determined might be detrimental to the public safety, or might in any vay assist the enemy or endanger the successful prosecution of he war. To this end, he may prohibit the publication or communication in any way of the invention, or application being nade for the protection of the invention in enemy, neutral, or llied countries, or any of His Majesty's Dominions. In the second lace, a month's notice [together with a provisional specification escribing the nature of the invention] must be given to the omptroller of the intention to apply for the grant of a patent in foreign country or in any of His Majesty's Dominions; and if uring the month the Comptroller is satisfied that the publication f the invention might be detrimental to this country in the ways lready mentioned, he may make a similar order as in the case f patents applied for in the United Kingdom.

OBITUARY.

Mr. George T. Egglestone, who died at Wolsingham last unday week, aged 64 years, was for a long period connected with e Consett area of the Weardale and Consett Water Company.

The Assistant-Secretary of the Tynemouth Gas Company, Mr. obert Harrison, died last Sunday week, after a paralytic eizure, at his residence at North Shields. Deceased, who was 9 years of age, entered the service of the Tynemouth Gas Company, in the clerical department, 43 years since; having before at been in the service of the North-Eastern Railway Company t Tynemouth Station.

Last Wednesday the funeral took place at Bradford of Mr. ames Kay, who died the previous Saturday, in his seventy-sixth ear. Mr. Kay for ten years—from 1888 to 1898—represented est Bowling on the Corporation, when the great question under iscussion was that of the Nidd Valley water scheme; and Mr. ay associated himself with the late Alderman Holdsworth and hers in pressing for the gravitation scheme.

Lieutenant Tom V. Dann, the eldest son of Mr. Thomas Dann, ngineer to the Bedford Gas Company, was killed in action in landers last Sunday week. Lieut. Dann, who was 29 years old the 1st inst., joined the 1/6th South Staffords in August, 1914, a private, and quickly rose to be Company Sergeant-Major. e was offered a Commission on the field, and was gazetted on ug. 24 last. Mr. Dann's second son has been through the sing in South Africa, and was with General Botha through the outh-West Africa campaign. This force is now disbanded.

The death occurred at Buxton last Thursday week of Mr. illiam Morris, who was for upwards of fifty years with the ent Water Company and the Metropolitan Water Board. He as born in Mill Lane, Deptford, nearly eighty years ago, and was e eldest son of Mr. W. R. Morris, who sunk the first artesian ell for the Kent Water Company about 1835. Mr. William orris (who more recently lived at Brockley) served under his ther for seventeen years, afterwards becoming Engineer to the ompany, and later District Engineer for the Water Board. In 07, when he had completed fifty years of service, he was presented with a fruit, sweet, and flower stand, in commemoration of e event, and in token of the regard and esteem in which he was ld by the staff. He retired some six years ago, with the best shes of all with whom he came into contact. Deceased was ade a member of the Institution of Civil Engineers in 1877, and s also a Fellow of the Geological Society.

Imperial Continental Gas Association.—The Secretary (Mr. W. Wilson) notifies that, at a Board meeting held last Wedsday, the Right Hon. Lord Gorell was unanimously elected Director of the Association, to fill the vacancy on the Board used by the death of the Hon. Sir E. Chandos Leigh, K.C.B., K.C.

The Late Mr. Lyon.—Mr. John George Lyon, F.I.C., F.C.S., P., head of the firm of Stainsby and Lyon, Limited, chemical anufacturers, of Knottingley, Yorkshire, who died on Aug. 27, ed seventy-three, left estate of the gross value of £244,263, of ich the net personalty has been sworn at £236,904.

Acetylene Gas Generation.—An acetylene gas generating appatus, in which the gas is claimed to be made non-explosive by xing it with oil gas—the two gases being produced simultanesly—has, according to the "Chemical Trade Journal," been tented in the United States. The gas is intended for welding d cutting metal, but may be used also for mine and other lamps, mestic purposes, &c., as the cost of production is said to be ry low. The generating charge is put up in a sealed cartridge, d water is fed to the carbide under control. The cartridge has entral tube, around which are packed layers of carbide, septed by layers of sawdust saturated with crude oil. Sand or er inert material may, however, be used instead of sawdust. hen water is admitted to the central tube, it starts the conrsion of the bottom layer of carbide, the heat from which porizes the oil in the first layer of sawdust, and so on, with the ers in turn. The oil vapour serves to absorb any excess of ygen. The cartridges are made in various sizes.

VIVIAN BYAM LEWES.

We close our journalistic week with sad news. Under tragic circumstances, Professor Vivian B. Lewes, F.I.C., Professor of Chemistry at the Royal Naval College, and Chief Gas Examiner to the Corporation of the City of London, and long-time friend of the gas industry, died on Saturday night, at the residence of Mr. William Buckley, Chairman of the North Wales Munitions Board, at Hafod, near Mold. The end was due to an attack of double pneumonia. He had an engagement at Mold last Tuesday, to deliver a lecture under the auspices of the Educational Trust, on "The Explosives used in the Great War"—a subject on which his connection with the scientific work at the Royal Naval College eminently qualified him to speak. On reaching the railway station at Mold, he was found to be in a state of collapse, and was at once removed to the house of his host, Mr. Buckley. His condition gradually worsened, and Mrs. Lewes was summoned; but, despite all possible effort, the sufferer passed away on Saturday night. Professor Lewes was in his sixty-fourth year.

Thus the end of a prominent personality in the fortunes and work of the gas industry, among the men of which he was so highly popular, and which men without exception entertained for him something akin to affection for (even apart from the fruits of his scientific gifts and distinguished ability) his own manly qualities, and uniformly kindly and charming disposition. We mourn one who was a distinct asset to the industry; one who occupied in it a unique position. It is said that no man is irreplaceable; but if any man ever stood astride this proverbial saying that man was Professor Lewes. There is no one who can at once take his place as a popular lecturer in and for the industry, no one who has the gift of making the dullest of subjects so pleasant as he could make them, no one who has such a broad and ready grasp of facts on all sorts of subjects of inherent importance in the work of the industry or having close alliance with that work, no one who has those facts so available on the tip of his tongue, no one who can so readily fence over them with his adversaries (our friend rarely had any), and there is no one more apt than he was as an investigator of diverse subjects, and capable of promptly reading and appreciating the value of the results. He could take current conditions, and critically examine them for prospective importance. He could look with the deepest seriousness on things, and could see the light side of the same things. In this power were the extremes of a large talent and disposition; and between the extremes lay much else that was distinguished for good and worth. It was a composite ability and character that we had in Professor Lewes, such as is given to few men; and therefore it is that we cannot feel as we contemplate his loss to-day, and the sudden cleavage of a long personal friendship, that he is replaceable.

It was in 1888 that Professor Lewes was first brought prominently before the gas industry, by editorial references in the "Journal" to a lecture that he had delivered to the Royal Institute of British Architects, on "Illumination and Ventilation." At that time—some twenty-seven years ago—Professor Lewes was associated with the Royal Naval College; but we then addressed him as "Mr." His work there in connection with matters of scientific importance to the Navy—such as the chemistry of coal and its combustion, oils, drinking waters, boiler incrustation, corrosion, spontaneous combustion, ventilation, and much else—provided the pathway to work in the gas industry, in which work he felt such large delight and interest, but which work could have produced but inadequate compensation for the enormous amount of time that must have been spent in historical research and personal scientific investigation. When in 1903 the Institution of Gas Engineers paid him a trubute of their high regard by making him an honorary member, he spoke of the great interest with which he had been provided by the ample opportunities afforded by the gas industry's primary and secondary products, and that interest and his association were never even temporarily broken. Some five years after Professor Lewes's (as we put it) prominent introduction to the gas industry—"prominent" because, as will be seen from a reprint below, he was on the border of the industry in minor capacity before—he was a candidate for the position of Gas Examiner to the City of London; and the copy of his letter of application is to-day of interest. It was to the point, it was modest, and it showed that, when speaking of himself, he was on a topic that he could treat with brevity, and not with that breadth that was a feature of some of his lectures. Here is his application (which was dated January, 1892):

> *To the Lord Mayor, Aldermen, and Common Council of the City of London.*
>
> My Lord and Gentlemen,—
>
> I beg to offer myself as a Candidate for the Post of Gas Examiner to the City of London.
>
> I am Professor of Chemistry at the Royal Naval College and for a very long time have devoted myself to the study of questions connected with Coal Gas and Illumination, having been for several years Principal Assistant to Dr. A. W. Williamson, F.R.S., the Chief Gas Examiner, and subsequently an Assistant Gas Examiner, in the City for upwards of ten years—an appointment which I only resigned last spring.
>
> I have contributed many original papers and researches to the learned Societies; amongst which I may quote papers on "The Analysis of Illuminating Gases" and "The Analysis of the Products of Incomplete Combustion," read before the Society of Chemical Industry last April; "On the Enrichment of Coal Gas by Car-

> buretting Materials other than Cannel," read before the Incorporated Gas Institute in July last; and was selected to give a course of Cantor Lectures on "Gaseous Illuminants," delivered at the Society of Arts in the Autumn of 1890.
>
> I am the Author of a book on "Service Chemistry," which is the manual used in the Navy, and also of a text-book on "Inorganic Chemistry," whilst I have a work on "Air and Water," at present in the press.
>
> I was last year the recipient of the only Gold Medal ever given by the Institute of Naval Architects, which was awarded me for a Research on Boiler Deposits, and am at present engaged on extended researches on the Light-Giving Properties of Flame and the Latest Improvements in the Manufacture of Illuminating Gases, which will be published at an early date.
>
> I shall be forty years of age next March, and have been for some years a Liveryman of the Shipwrights' Company.
>
> I am fully conversant with every detail of the Gas Examiner's duties, and, should you honour me by selecting me for the post, I shall do my utmost to prove myself worthy of your confidence.—I am, Gentlemen, your obedient Servant,
>
> Vivian B. Lewes.

He obtained the appointment, and held it up to the end. But though he occupied the official position, the Corporation were ever generous in not placing any veto, except where their own interests were concerned, upon Professor Lewes rendering help to the gas industry. The Corporation have lost an excellent adviser; and one who has kept them, in their relations with the gas industry, upon the track of practicability, and has not let them down, as has been the case in some other instances of "scientific" counsel, into utter absurdity.

Speaking of his relations with the City of London reminds of Professor Lewes's work in the parliamentary arena as an expert witness. He was often there—not only in connection with the gas industry, but in association with other affairs, Metropolitan and provincial. He was in all the big fights of the past quarter of a century in which the gas industry has been engaged—especially in the contests in which Sir George Livesey took the lead, which had for their object, and which gained, greater liberties for the industry in the matter of the illuminating power standard, the application of the "Carpenter," or "Metropolitan" No. 2 burner to gas testing, the abrogation of the sulphur compounds clauses; as well as in connection with the water-gas controversy, and the establishing of the calorific value standard, which last-named he long since advocated. In fact, his lecture before the Institution of Gas Engineers, on "Candles and Calories," in 1903, is worth reading to-day in the light of subsequent events. He helped the industry hugely in the Parliamentary Committee rooms, and was soon popular with every Committee before whom he appeared. And the members of the Parliamentary Bar always preferred to be on the side where Lewes would be for them rather than against them. His abilities shone when he was in the witness chair; and the gift of repartee which he possessed in an uncommon degree was a weapon which he skilfully handled to the discomfiture of his opponents. When he was in a case, and when the information passed along that "Lewes was in the chair," the loiterers about the corridors of the Committee rooms were speedily there for interest, and because they knew that Lewes would not have the worst of the forensic encounter.

What need is there to speak of his numerous lectures and papers specially associated with the industry? They are well known; they live in recollection. They were always instructive; and interest in them never flagged. Professor Lewes frequently lectured before the Institution of Gas Engineers on divers subjects; and no one received a greater ovation. Among the members he was popular; and though some of them entertained the view that he committed a little indiscretion (from and during the time he became associated with the ill-fated Coalite Company) in persistently advocating low-temperature carbonization for the gas industry and the abandonment of high temperature, notwithstanding the changed conditions produced by heavy charging and vertical retort working, which undermined many of his arguments, still to them he was the same Lewes, the same friend, the same stalwart example of a fine *bonhomie*. His Cantor and other lectures at the Society of Arts were always a treat; and the cool manner, the merry hit, the capacity for bringing the abstruse to the comprehension of the layman, will, by the future absence of the popular lecturer, cause a void for the audiences in the famous theatre on many a Monday and Wednesday evening. The Professor nearly always dictated his lectures to a typewriter before he delivered them; but never a word read he. He would stand up, and, save for side jests and quips, give running testimony to a remarkable memory by going through his planned lecture *literatim* as dictated. It was a performance that ever caused marvel among his friends. But those lectures as well as the ones delivered before the Institution of Gas Engineers showed the wonderful capacity and area of interests of our lost friend. He was as much at home on the science of modern explosives as he was on the theory of the incandescent gas mantle, the hygienic aspects of gas lighting and gas-fires, fuel, carbonization, acetylene, air gas, oil, and many other subjects.

Professor Lewes was the producer of various text-books—some of them bulky ones, and the labour put into them must have been immense. He was, in fact, a great, quick, and accurate worker; but the essence of the work was all that met the public eye. His principal books are on "Service Chemistry," "Inorganic Chemistry," "Acetylene," "Air and Water," and "Carbonization." There is a passage in the Professor's preface to "Service Chemistry" which always struck us as being peculiarly apt, and as having very wide application. It is this: "Whilst using the title 'Service Chemistry,' I wish it to be clearly understood that there is but one chemistry, and that its technical adaptation to any special subject is merely an amplification of the science in a particular direction, which cannot be properly done without at the same time mastering the general principles of which the technical application merely forms a small branch, and that a knowledge of the chief principles and theories of chemistry is absolutely essential before any useful application of the science is possible." This reference to the standard literature that came from the prolific brain and pen, has inadvertently displaced an acknowledgment of his useful work in connection with the British Commercial Gas Association, and other organizations. We have also before us as we write the well-known figure with characteristic speech and action, as he stood, or paced the platform, before the audiences with which he filled to overflowing the large lecture room at the National Gas Exhibition in the jubilee year of the Institution of Gas Engineers. Our friend also put his hand to invention. Many years ago, he carried out the celebrated experiments at the South Suburban Gas-Works in the passing of blue water gas through coal gas retorts; and it may be that the intermingling which he then proposed, by which to break-down rich coal gas with a lower calorific value gas, and so give gas to the consumers in the form in which it would be of greatest service under the present modes of utilization, will yet come to pass, and will prove that Professor Lewes was merely before his time in this matter, and that he possessed long-range foresight. He was identified with Mr. C. B. Tully in the methane-hydrogen process.

Professor Lewes was married twice—the second time in 1904, to the youngest daughter of Colonel Lewis-Jones, J.P., of Westgate-on-Sea. To the widow, heartfelt sympathy will go forth from the industry in which her husband had countless friends.

Nothing more need be said. About the final resting-place of our friend will cluster the happiest memories of him, of his work, and of his character, all of which memories were unconsciously sown and established by himself among those who were fortunate in being intimates, and among those who had more distant knowledge of him, but yet were attracted by the magnetic influence which he possessed, and which he communicated to them through the channels of his public work.

PERSONAL.

Lieutenant S. P. Thornton, of the 10th Leicesters [who was a representative of the Richmond Gas Stove and Meter Company, Limited], has just received promotion to Captain.

Mr. Henry Tobey, who for the past twenty-five years has been Engineer and Manager to the Filey Water and Gas Works, as also of the Malton Gas Company, has tendered his resignation of the former position.

Mr. Harold Galleway, son and formerly a pupil of Mr. W. M. Galleway, the Secretary and Manager of the Whitby Gas-Works, has received a Commission as Second Lieutenant in the Northumbrian Brigade Royal Field Artillery (T.).

The announcement is made in our news columns to-day of the resignation by Mr. W. J. R. Baker of the position of Gas and Water Engineer to the Mansfield Corporation, to which he was appointed from Malvern, on the death of Mr. Arthur Graham, in July, 1913.

Mr. William Higgs, the Engineer and Secretary of the Basingstoke Gas Company, has been placed on the Commission of the Peace for the County of Hampshire; and he qualified as a J.P. at the Hants Quarter Sessions at Winchester last week. Mr. Higgs's public work in the county and the borough of Basingstoke has been mostly in connection with educational work.

Mr. H. C. Dyer has been appointed Carbonizing and General Foreman to the Bishop's Stortford, Harlow, and Epping Gas and Electricity Company. Mr. Dyer served his articles under the late Mr. S. W. Durkin at Southampton, and was for eight years his Junior Assistant and Chemist. Since then he has been Chemist, Works Superintendent, and Assistant-Engineer successively to the Oriental Gas Company at Calcutta.

Councillor J. A. Macdonald, who is Chairman of the Ilkeston Corporation Gas Committee and the present Mayor of the borough, has consented to remain in the position of Chief Magistrate for another year, having regard to the exceptional circumstances created by the war. This will be his third year of office. To the great gratification of his colleagues, and of the townspeople generally, Councillor T. Smith, the Chairman of the Mansfield Corporation Gas Committee, has consented to accept the nomination to the Mayoralty for the ensuing year.

The Gas Committee of the Llandudno Urban District Council yesterday week interviewed a number of candidates for the position of Manager of the works, and afterwards decided to recommend the Council to appoint Mr. A. M'Gregor, of Colne, Lancs. Mr. M'Gregor—whose appointment was confirmed by the Council on Friday—succeeds Mr. Walter Shadbolt, who (as already announced in our pages) has been appointed Gas Engineer at Fleetwood, in succession to his brother. He is the eldest son of Mr. James M'Gregor, the Engineer, Manager, and Secretary of the Mold Gas and Water Company, with whom he gained his early experience. Following this he served his articles with the ıester United Gas Company under their present Engineer and anager, Mr. J. C. Belton—being afterwards promoted to the ıst of Technical Assistant. During the five years he spent at ıester the carbonizing plant was entirely remodelled, and stoking achinery was introduced. He held the post until appointed to ılne (Lancs.) as Assistant Engineer and Manager, under Mr. ed. Thorpe. He has been at Colne for twelve years.

After occupying with marked success for nearly thirteen years post of Engineer and Manager of the Hebden Bridge and ytholmroyd Gas-Works, Mr. E. J. Wellens is about to take up position of Works Superintendent at the Grimesthorpe stat on the Sheffield United Gas Company. Mr. Wellens commenced training under Mr. T. Duxbury, of Middleton, in 1890, and at age of 26 was appointed to Hebden Bridge. At that time the ıke of gas averaged 80 million cubic feet a year; while to-day has increased to 106 millions. Since Mr. Wellens took charge the works, the price of gas had been decreased from 3s. to 2s. 1000 cubic feet for gas-engine consumption, and from 3s. 3d. 2s. 9d. for lighting and cooking. Under his supervision, many portant improvements have been carried out. The Board have quired land, upon which a new gasholder and governor-house ve been erected. The works have been practically remodelled, d vertical retorts installed. It is estimated that these new rks and extensions have involved an outlay by the Board of 6,000. In Hebden Bridge, Mr. Wellens will be greatly missed. a meeting of the Board last Thursday night, Mr. Wellens' ignation was accepted with regret; hearty wishes being expressed for his future success.

AN EXPOSITION OF CARBONIZATION.*

ᴊsᴇꜰᴜʟ little review on coal distillation, gasification, and bye-ducts has been prepared by Mr. J. E. Christopher, of which subject-matter, for the most part, has previously appeared articles published in "The Science and Art of Mining." He ides his review into nine chapters, of which the titles, in order, : Coal Distillation; Manufacture of Coal Gas; Coke Manuture; Manufacture of Producer Gas; Bye-Products; Tar; ımonia; Benzol; Bye-Products from Blast-Furnaces.

He deals perhaps rather more thoroughly with the coke-maker's n the gas-manager's outlook on the carbonization of coal; but ıll cases he handles his subject in a suggestive and instructive nner. He has compressed into a small compass a reliable cription of the practice and principles of gas and coke manuture; and students may turn to his little book with confidence t they will glean nothing from it which their later studies will e-out as incorrect.

The only point on which we are inclined to differ from Mr. ristopher is as to the relative values of the products from gas-orts. He ascribes 67 per cent. of the total value to the gas, ch is a percentage that would be obtained only if the coke and er bye-products were rendering quite abnormally low returns. vould almost seem as though he had added to the value of the part of the cost of distribution.

n so small a volume it would be impossible to refer fully to or impurities and bye-products; but Mr. Christopher has not, think, said enough about cyanogen compounds—probably be-se they are of less moment in coke-ovens than in gas-works. ese are, however, quite minor blemishes in a work which is ularly free from faults.

"Coal Distillation, Gasification, and Bye-Products." With Forty-One strations and Diagrams. By J. E. Christopher (Wigan Coal and Iron pany, Wigan Technical College, Member of the Society of Chemical istry, Joint Author of "Modern Cooking Practice"). Published by mas Wall and Sons, Limited, of Wigan. 1915.

Gas Companies' Protection Association.—The eighteenth ual meeting of the Association will be held at the Westminster ace Hotel on Friday next, to receive the report of the pro-dings of the Association, the accounts and balance-sheet for past year, to elect five members to serve on the Committee lace of those retiring, and to transact other general business. members of the Committee retiring, but offering themselves re-election, are: Mr. G. Andrews, of Swansea; Mr. G. Clarry, Cardiff; Mr. R. W. Edwards, of Aldershot; Mr. T. H. Hazell, lewport (Mon.); and Mr. Douglas H. Helps, of Reading.

Gas and Petrol Engines at the Panama-Pacific Exhibition.—t week's "Engineer" reported that one of the largest exhibits ıternal combustion engines at the Panama-Pacific Exhibition ıan Francisco is that of the Standard Gas-Engine Company ıan Francisco. The engines are of the vertical marine type, used for marine purposes as well as on land. They are ipped with overhead valves; the igniter being in the centre of cylinder head and directly above the piston. The igniter is he make-and-break or hammer type. The crank case is ordi-ly left open at the ends to permit of ready inspection of the n bearings; but it is so made that it can be closed quite tight, prevent the escape of burned gases into the engine-room, ood ventilation cannot be provided. The engines are built one, two, and three cylinders, with a power rating from 4 to H.P. These engines have cylinders 13½ inches by 17 inches, run at 225 revolutions, driving a propeller 5 feet in diameter. weight is about 12 tons.

STAFF CHANGES AT LIVERPOOL.

Certain changes in the staff of the Liverpool Gas Company have taken place, following the death of Mr. Edward Allen and the provisional appointment of Mr. Ralph E. Gibson as Engineer.

Mr. Ernest Astbury, the Superintendent of the Linacre works, has now been appointed Assistant-Engineer to the Company—succeeding Mr. Gibson; and Mr. Edward Allen (son of the late Engineer), their Chief Draughtsman, has been placed in charge of the Linacre works, in succession to Mr. Astbury.

Mr. Astbury was for three years an articled pupil to Mr. B. W. Smith (now at Walsall) at the Smethwick Gas-Works, and subsequently acted as his assistant for one year. He then joined the staff of Messrs. W. J. Jenkins and Co., of Retford, and was for two years engaged on constructional work for the firm. Mr. Astbury then obtained an appointment as Assistant-Engineer to the Smethwick Corporation Gas Deparment under Mr. Vincent Hughes; and, after two years' service in this capacity, he joined the staff of the Liverpool Gas Company—first as Superintendent of the Athol Street and Eccles Street works (for 6½ years), and since 1911 he has held the more responsible position of Superintendent of the Linacre works.

Mr. Edward Allen received his training in the works, shops, and drawing office of the Liverpool Company. He was subsequently appointed Junior Draughtsman and became Chief Draughtsman in 1904. In this capacity he has gained valuable experience in connection with the extensive additions and alterations to the works and plant of the Company carried out during recent years. He has also acted in a temporary capacity as Superintendent of works on more than one occasion. Mr. Allen has been successful as lecturer in gas supply at the Liverpool Technical School.

PHOTOGRAPHIC RECORD OF METER INDICES.

In the "Journal" for the 7th ult. (p. 494), a note appeared (on the authority of the New York Correspondent of the "Daily Telegraph") as to the meter inspectors of the Consolidated Gas Company employing cameras for taking records of the meter indices throughout their districts; and in the "Journal" for the 14th ult. (p. 571), we gave from the "American Gaslight Journal" particulars of the apparatus said to be used and the operations involved—accompanied by two illustrations. Being wishful to get further information as to how the work was carried on, a letter was sent to the Company's officials. In response to it, Mr. Lewis B. Gawtry, the Vice-President of the Company, under date of the 30th ult., wrote to say that he had read "with interest and surprise" the statement that the meter-readers employed by the Company would in future be taking a photograph of each meter-index to file with the Company's records. Mr. Gawtry continues: "There is absolutely not a word of truth in this report; and the Company have not such a scheme under consideration. Our meter-readers index some 11 million gas-meters and some 3½ million electric meters each year; so it will readily be seen how difficult the taking of these millions of photographs would be, let alone the filing thereof. We may be guilty of many indiscretions, but we are not guilty of this one, as yet." Mr. Gawtry asks us to deny the fact that his Company are making any such arrangement as was indicated.

The October issue of the "American Gas Institute News" quotes the "New York Times" as saying—evidently in regard to some other place than the capital city—that meter-readers will in future be able to photograph meter-indices; and it is believed that "by adopting this method it will ensure an accuracy which it is hardly possible for the hand, eyes, and mind to attain in keeping such records." The readers will, it is said, be equipped with a small camera and a spool of film; the entire outfit being not unlike the ordinary camera. The camera fits over the indicator in the gas-meter; and by pressing a button a flood of electric light is thrown on the dials, and the exposure is made. The entire operation requires only a fraction of a second. A safety device prevents the making of double exposures; so that inexperienced meter-readers will find little difficulty in snapping the photographs. The readings will be made from the negatives by the bill-clerk. Identification of each meter will be made by means of a numbered tag stuck on the side or below the dials, which also will be contained in the photograph. The name of the new photographic meter reading device is said to be the "Factograph."

Sulphate of Ammonia Production in India.—At the last annual meeting of the Mining and Geological Institute of India (according to the "Chemical Trade Journal"), Dr. H. H. Hayden, referring in the course of his presidential address to non-metallic minerals other than coal, said that India was in very much the same condition as it was some eight years ago. A cheap supply of sulphuric acid available for use at the coalfields would be a strong incentive to the utilization of those valuable materials now being wasted in most of the coke-ovens and to their recovery in the form of sulphate of ammonia and tar. It was many years since the East India Railway Company set up their recovery plant at Giridih; and it was rather remarkable that their example had not been more widely followed.

INTERNATIONAL GAS CONGRESS AT SAN FRANCISCO.

By Arthur H. Elliott, Ph.D., M.S.

About 400 gas engineers mustered on Monday, Sept. 28, at the "Native Sons Hall" in San Francisco, and opened one of the best meetings American gas engineers have seen in a number of years. The rooms and conveniences provided by the local organizations have been well thought out and generous.

The annual meetings of the American Gas Institute and the Pacific Coast Gas Association were arranged to occur at the same time as that of the International Gas Congress at San Francisco; and this brought a large attendance of American gas engineers.

The Pacific Coast Gas Association held a short meeting, received a number of reports of Committees, elected officers, and listened to the retiring President's (Mr. E. C. Jones's) address. He gave an account of the new oil-gas process worked out on the Pacific Coast, where gas is made entirely from oil, and with great success. He noted that in 1893 California produced about 470,000 barrels of oil, and in 1914 102,881,907 barrels were produced. Every foot of gas in California is made from oil without the use of coal. President Jones also spoke in glowing terms of the work in the course of gas engineering at the University of California, which has been inaugurated and maintained by the Pacific Coast Gas Association. [The main portions of the address were given in the "Journal" last week, p. 134.—Ed. J.G.L.]

Mr. John A. Britton, of the Committee on this matter, also gave a good account of its work, and said that it was raising the standard of gas engineering throughout California. More will be heard from this later.

On Tuesday, the International Gas Congress was opened by the President, Dr. Alex. Humphreys; and Mr. E. C. Jones, on behalf of the Pacific Coast Gas Association, presented him with a handsome silver mounted gavel of California redwood.

Dr. Humphreys then gave his address, and congratulated the members on the large attendance of delegates and the enthusiasm shown at the Congress—and all in spite of the war. His theme was Public Service Commissions and their relation to corporations and consumers. It was received with much applause. [The address appeared in the "Journal" for Oct. 12, p. 89.]

The paper on "The Development of Water-Gas," read by O. B. Evans, was largely historical. Nevertheless, the paper, and the one on "Deep Fuel Combustion as Applied to Water-Gas Manufacture," by Arthur G. Glasgow, were well discussed by Dr. Humphreys, and Messrs. W. C. Morris, Spitzglass, Elliott, John A. Britton, E. C. Jones, Earnshaw, W. A. Wood, and F. Thuman. The discussion was largely along the line of oil decomposition and the influence of ash of fuel on the action of steam and air; also the regulation of the quantity of air and steam admitted to the generator. The call was for a better study of the influence of clinkers. The variation in the quality of oil, too, was touched upon. It was also the consensus of opinion that calorific value was easier to work to than the photometric standard. [These two papers were given in the "Journal" for Sept. 28, p. 705.]

A paper entitled "The Substitution of Heating Value for Candle Power as a Standard for Gas Quality" was read by Mr. R. S. M'Bride, of the United States Bureau of Standards. [See "Journal" for Sept. 28, p. 702.] The discussion was participated in by Messrs. C. O. Bond, E. L. Hall, Vincent, E. C. Jones, Maxon, H. L. Strange, R. A. Carter, jun., and Dr. A. C. Humphreys. The opinion of the meeting seemed to be all in favour of good average and constant quality, together with enough pressure, and higher than the average now used. Good service was said to be better than large dividends.

In closing, Mr. M'Bride said the Bureau of Standards stood for principles not to determine rules. Ideal gas for light, not ideal for heat and power. Locality also determines standards. Must look to conserving the Earth's energy. Don't sacrifice present needs to future friends. Heat units give the best service we now have.

On the afternoon of Tuesday, the American Gas Institute held their annual meeting, and after listening to the retiring President's (Mr. E. C. Jones's) address, the officers were elected.

A number of reports of Committees of the American Gas Institute were then read. The Committee on the Beal Medal for the best paper presented to the Institute last year reported in favour of Mr. F. W. Steere, for his paper on the "Electrical Process of Detarring Gas."

A number of invitations were received from various cities to hold the next annual meeting in them; and the question was left with the incoming officers to decide.

The President (Mr. E. C. Jones), in his address [*ante*, p. 91], noted the large gathering of gas engineers and the great pleasure the people of San Francisco felt in receiving them. He also noted the Collective Gas Exhibit, which received a Grand Prize from the Panama-Pacific International Exposition and a silver loving cup for the best decorated exhibit in the Manufacturers' Exhibit. He also spoke of the good work of the Public Relations Committee of the Institute, and recommended its report to all the members.

The rest of the time of the Institute was devoted to the sessions of the Gas Congress.

On Wednesday, the work of the Gas Congress was divided into two sessions—one a Commercial Symposium, and the other a symposium on Illumination. Both of these meetings were largely attended. [For abstracts of the papers presented, see the "Journal" for Sept. 21 and 28, pp. 653, 713.—Ed J.G.L.]

The Commercial Symposium, in separate section, was under the leadership of Mr. C. Willing Hare, of Philadelphia; and the Chairman was Mr. E. C. Jones, of San Francisco. The nine papers were all well discussed by Messrs. E. C. Jones, Harry L. Strange, W. A. Wood, Spitzglass, C. W. Hare, and others. Many points in service and the sale of gas were discussed; and the key note was "Good Service." Much good should come out of this discussion, and the full report of the remarks should be read by all who wish points in gas commerce.

Another section was devoted to the symposium on Illumination, under the leadership of Mr. C. O. Bond, of Philadelphia, with Dr. A. C. Humphreys in the chair. The papers—all good, and seven in number—were discussed by Messrs. W. C. Morris, John A. Britton, Professor Corey, of the University of California, Bond, Tuttle, Dr. A. C. Humphreys, Dr. A. H. Elliott, Vance, and others. The spirit of the discussion was the calling of attention to lighting and the abolition of glare; also in favour of many small side lights in rooms, as against chandeliers. These reports also should be read by all. They contain many points in favour of gas lighting under good pressure, and also upon the hygienic value of gas lighting. For the gas engineer the papers and discussions are very valuable, and reflect great credit to Mr. C. O. Bond, who gathered them for this symposium.

On Thursday, the International Gas Congress held its last regular session, at which Dr. A. C. Humphreys presided, with a large attendance of all the gas engineers. The paper contributed by the Society of Gas Engineering of New York was read by Mr. R. A. Carter, jun., "On Modern Coal-Gas Processes," and was intended as a review of present American practice. It was very full of information, and required study to properly discuss it. Those who discussed it were Messrs. W. C. Morris, C. H. Nettleton, and C. O. Bond; and written communications were promised by others after the Congress adjourned.

The English Symposium was read by Mr. George G. Ramsdell, the Secretary of the Congress, from abstracts prepared by the American Gas Institute. This was entitled "A Review of the present Practice in the Manufacture and Distribution of Gas by British Undertakings," prepared under the direction of the late Mr. Edward Allen, of the Liverpool Gas Company. [Four of the papers contributed were given in the "Journal" for Sept. 28, pp. 699-701.] After reading Mr. Allen's "Introduction" [*ante*, p. 79], a resolution was passed to send a cable message to England, and the following was transmitted: "Greetings from California. By resolution the International Gas Congress thanks Institute for Symposium on Gas Manufacture and Distribution, and wishes to convey to Mrs. Allen our sense of obligation and personal sympathy. We cordially reciprocate the sentiments expressed in the last paragraph Mr. Goodenough's paper."

The discussion of these papers was participated in by Messrs. R. A. Carter, jun., E. C. Jones, Moxon, A. E. Forstall, Gross, Earnshaw, Simmon, Keppelman, H. L. Strange, E. G. Cowdery, Weber, A. C. Humphreys, and C. H. Nettleton. In the course of the remarks, the question of welded pipes came out, and the methods of welding. Opinions differed as to the way of welding but welding as an improvement in pipe joints was fully endorsed by all. Pressure under distribution was also taken up, and high pressure advocated. Many pressures as high as 100 lbs. per inch were mentioned as being used with success. House governors have proved safe, and were recommended. Regulators with 3½ to 4 inch pressure to consumer appear to be the best. Some use as high as 150 lbs. for distribution.

The social side of the Congress has been a revelation of Cali fornian hospitality. Practically speaking, every expense pertainin to social events has been taken care of by the Pacific Coast Ga Association.

The first social function was a reception and dance at the Palac Hotel to Dr. Alexander C. Humphreys, with a ball and specia dancing by Chinese, which proved most graceful and charmin Then the ladies had special trips prepared for them around Sa Francisco and to Chinatown, which were unique, interesting, an enjoyable. An automobile trip to Golden Gate Park and luncheo at the Cliff House was another pleasant event.

Thursday was "Gas Congress Day" at the Exposition. Speci buses were provided, and addresses of welcome by the Presiden of the Exposition, Mr. C. C. Moore, Mr. John A. Britton, Mr. E. Jones, and others made everybody happy and in love with Sa Francisco. Here also three bronze medals were awarded—o to Dr. A. C. Humphreys, as President of the Gas Congress, and tw to Mr. E. C. Jones—one as President of the American Gas Inst tute, the other as President of the Pacific Coast Association.

Another event of Thursday afternoon was the lecture by M W. D'A. Ryan, an illuminating engineer, on "Illumination of t P.P.I.E." This was illustrated with lantern slides prepared an coloured specially for the Gas Congress. It was a beautiful a instructive lecture, and should be heard and seen to be ful appreciated. An organ recital by the Exposition Organist end a most delightful afternoon.

On Thursday evening, the banquet at the "Inside Inn" w given, and about 550 ladies and gentlemen sat down to a fi dinner, followed by a dance in the California Building.

At the dinner, Mr. John A. Britton, of the Pacific Coast G and Electric Company, was toastmaster; and his good humo as the moving cause of much good fellowship. One event as the receipt of a wireless message from Governor Pinkham, Hawaii, to Mr. Harry L. Strange, inviting the Institute to eet in Honolulu. This message was so arranged that Dr. and id Mrs. Humphreys, Mr. and Mrs. E. C. Jones, Mr. and Mrs. ressey, and Dr. A. H. Elliott were all connected on the line of e receiver and heard the signals perfectly over 2300 miles of ace. A reply was sent by Dr. Humphreys.

Another interesting feature of the dinner was the presentation Mrs. E. C. Jones of an ancient Hawaiian calabash (a large owl), many hundred years old, a gift from the Honolulu Gas ompany. It is made of very old wood, and polished and deco- ted. In the bowl was the Hawaiian greeting "Alcha Oe Nui," ich means, "Much love to you."

Mr. E. C. Jones responded for Mrs. Jones, and told Mr. Harry Strange to convey to their Hawaiian friends the greeting: May your troubles be over, And your pleasures increase."

On behalf of the lady visitors present (about forty), Mrs. O. N. ldlin, of Fort Wayne, Indiana, spoke in terms of high praise Californian hospitality and the round of pleasure they had perienced in their visit to San Francisco. She was a charming eaker, and her warm words were received with oft-repeated unds of applause.

The ladies of California, headed by Mrs. E. C. Jones and Mrs. n A. Britton, have done wonders in making the visiting ladies ppy and comfortable. Everything has been greatly enjoyed.

The Gas Congress ended its visit to San Francisco in a blaze glory from the special illuminations and fireworks prepared for day night. It is impossible to give in words an impression of grandeur and beauty of the spectacle. Mr. Ryan went around grounds with the visitors and explained the methods. A de- iption of this wonderful evening may later on be forthcoming m Mr. Ryan.

Everybody who attended the Gas Congress will never forget it; l it is going to be very hard to match it, let alone any question doing better.

IE BRITISH COMMERCIAL GAS ASSOCIATION AND THE SOCIETY OF GAS INDUSTRIES.

THOUGHTS AFTER LAST WEDNESDAY'S MEETING AT THE ROYAL SOCIETY OF ARTS.

By R. W. EDWARDS.

ERE was evidence at the gathering on the 19th inst. that an rshadowing influence materially reduced the attendance of nbers; but there were, notwithstanding, signs of a sincere rest being continued in the Association. The President's ress amply bore out this—both for its fresh and invigorating e, and the broad, but nevertheless convincing, review of the rations. He struck home, on more than one occasion, as to necessity for closer co-operation, with a view to obtaining nbers representing 100 per cent. of the gas undertakings. t this should be otherwise, now that the Association has so rally justified its existence, is somewhat of a wonder. The s of the contributions is so equitable that the smallest under- ng can participate without any strain, and, in like manner, the est undertaking's support be commensurate with its resources, of inestimable value to the Association. It is essentially a Operative Society—large and small are alike, whatever may heir geographical position. The statement made by a mem- that rarely a paper or periodical can be picked up without ng some reference, direct or indirect, to the manifold uses of shows how scientific and thorough are the management of funds and the business of the Association.

would not serve any useful purpose to dilate on this particular t to any great extent; but there is an object in this preface h deserves very serious consideration.

ith the British Commercial Gas Association there has been ted a bond of union between the gas undertakings and the ety of British Gas Industries. It has undoubtedly led to a r understanding, which one and all desire to be perpetuated; at the same time, the benefits arising have been participated utually by both sides. This being so, it is not an unreason- suggestion that there should be some semblance of equity in basis on which both great partners contribute to the support e Association.

was not until the accounts were actually under review at neeting that the point appealed to the writer this year. In ious years, he has referred to it both in the columns of the URNAL" and in open meeting. Therefore, the allusion that made on Tuesday was somewhat abrupt and certainly not over- ustive; hence the reference now being more amplified.

e report for the year ending Aug. 31, 1915, shows that the contributions from the Society of British Gas Industries £1365, as against, for the corresponding period of 1914 (to 30), £2378. Immediately, the ordinary member was struck the alarming difference between the Society of Gas Indus- modest contribution of £1365, compared with the total con- tions of the gas undertakings of £15,655; and, although it ght out (through Mr. Depree) the explanation that this sum of 5 had been, since the accounts were made up, increased to 6, this did not make the comparison at all a favourable one, nor reduce the large margin between the support of the two great partners.

Now the first point that must naturally appeal to all thinking members of the Association is the extent to which the members of the Society of British Gas Industries are contributing individually to this (not very liberal) sum of £2016. The names of the various gas undertakings that are members of the British Commercial Gas Association are published and open to all; and, in addition, the information as to the amounts contributed by each undertaking is accessible to the committees and to every member who may desire it. Thus, not only are members able to appreciate to the full extent the individual membership, but also the amount of their respective individual support.

That this information should be rightly exposed to all cannot for one moment be disputed. On the other hand, it can reasonably and pertinently be suggested that, in like manner, the Society of British Gas Industries should submit for publication both the names of, and the amounts given by, the contributing members of their Society; and then the gas undertakings will be able to thoroughly appreciate to what extent they are receiving co-operation, individually and collectively, from the Society.

That is the first and salient point which, to my mind, is a *sine quâ non* in connection with this great partnership. The next point is one more on the lines of a suggestion. The present basis of contribution by the gas undertakings is that of 2s. 6d. per million cubic feet of gas made, and—as was explained by the Chairman of the Executive Committee—this represents something in the region of 1d. per consumer per annum. Now it does not require a very high standard of mathematics to commute this basis to one applicable to our friends. On the footing just quoted, there is a basis of some 33,000 cubic feet per consumer per annum—in round figures, say 30,000 cubic feet of gas sold per consumer per annum. Adopting the figure of 4d. per 1000 cubic feet sold as the average profit, the result will represent 10s. of profit per consumer per annum. Thus, in simple words, the gas undertakings contribute an equivalent of 2d. in the pound per annum.

If this basis is found equitable, reasonable, and sufficient from the gas undertakings, why is it not so from the members of the Society of British Gas Industries? I seriously suggest that it should be the equivalent basis for our partners to subscribe on in future, and thus avoid the very invidious position they are now placed in, by obtaining equal rights, equal privileges, but only contributing a very paltry sum in comparison with that received from the gas undertakings.

If it should so be that the subscription of £2016 from the Society of British Gas Industries be derived from but few of its members, and not equally from the whole, then it is to be hoped those few will not level-down their contributions to the twopenny basis—to the disadvantage of the "B.C.G.A."—until they have prevailed on their fellow-members to contribute on an equal basis; the net result and object being to more equally compare with the aggregate subscriptions received from the gas undertakings.

I cannot estimate the effect of the twopence in the pound basis, as the total profits of the firms who are members of the Society of British Gas Industries are unknown to me; but my object is rather to do good than harm in the interests of the "B.C.G.A."

It may be rightly assumed that, as a whole, there is a feeling of great friendship—especially strengthened of late years—between the gas undertakings and the gas industries. It has been found that, by a reasonable spirit and a degree of reciprocity, better net results are obtained in the sales of gas. Very well! This being so, let both great partners join hands truly and equally; and the Society of British Gas Industries contribute their full share to the common expenditure.

There is a good deal more which could be said; but the time is scarcely opportune to enter into deep discussion or argumentative details. Having regard, however, to the fact that there has been a strong feeling, unanimously expressed, in favour of carrying-on the Association during these very serious and trying times, caused by the great war now raging, I suggest that what has been said is sufficient to appeal to all, and that the two points that have been made would be respected and complied with.

There was a different feeling, too, in the natural attitude of the gathering. There was an absence of that unfortunate expression, so frequently made use of a year ago, "Business as Usual." No one seriously, with the job that the country has now got on, could possibly, in his sane moments, talk of "Business as Usual." It was a stronger, quieter, but optimistic attitude this year—one pledged to "carry-on." And here, I think, the matter can be safely left in the hands of the Executive Committee, presided over by that great organizer, Mr. F. W. Goodenough.

The President touched on a retrospective incident. He harked-back to the Munich visit, and mentioned a point over which the enemy was somewhat remiss. He did not, however, unfold the whole of the tale, as he probably would have done, had not war since broken out.

There was one notable absence, which many, I am quite sure, noticed—that was the personality of our late member, Mr. Edward Allen, of Liverpool. Always in the forefront in all matters appertaining to the gas industry, he has left a gap which must be open for some time before it can be adequately filled.

And so the meeting drew to a close, shifting the centre of gravity from Glasgow to Birmingham, where we all of us feel will be exercised that generous and unremitting attention which has all through characterized the activities of the highly respected Bailie Paxton.

ELECTRICITY SUPPLY MEMORANDA.

The Ground of Development.

SOME crude views exist as to how it is that trading in electricity has made large progress, and simultaneously the gas industry has gone on its way rejoicing, showing ever-fattening sides, despite competition. Thoughtless people have concluded that the electricity industry has built up its substantial (though it is not always paying) business wholly by cutting huge lumps from the business of the gas industry. If this were true, it would be too great a compliment to the gas industry for our electrical friends to digest, seeing that it would mean that the gas industry had shown a mighty vitality if it could compensate for the losses represented by the whole volume of the electricity business, and added to its circumference in the remarkable manner that has been witnessed. Of course, there are other causes for the two industries having made such considerable synchronous advance, and for the gas industry having shown so robust a constitution in dealing with the appropriations from it of the electrical industry, which appropriations are far short of the total volume of the business of the latter. The "Electrical World"—an American publication—has recently published an article on "The Stability of the Central Station Industry"—the writer being Mr. Frederic Nicholas, who is a member of the editorial staff. He labours under no delusions as to the business of the electricity industry having been captured from the gas industry. A very large proportion of it was never in the possession of the gas industry; and the bulk of it is due to general development of population, the world's requirements, enterprise, and all that goes to make up progress. So, too, the gas industry's remarkable growth is due to the same causes, and to new developments of the application of gas and of its secondary products.

Illustration.

Mr. Nicholas points out that during the decade ending with 1912, the cost of construction and equipment of central electric stations in the United States increased by 334·7 per cent., outstanding capitalization by 227·1 per cent., gross income by 254·2 per cent., and output in kilowatt-hours by 375·8 per cent. In the decade ending with 1909 (it is a pity the figures have not coincidence in time), in gas manufacture there was a gain of 61·5 per cent. in capital, and 120·3 per cent. in the value of the products, which is a profitable state of things, inasmuch as it shows that business has gone ahead faster than capital, which means that there has also been advance in economy in manufacture. It must be borne in mind, too, that percentage figures based on the position to which the gas industry had arrived prior to the decade have no comparative value in relation to the progress made by a more modern industry. The bases upon which the percentages are calculated are altogether different. Industries thrive upon each other; and when Mr. Nicholas points to examples of the development of other industries, he shows where the two industries—gas and electricity—have found much of the ground upon which to develop. For instance, the agricultural industry in the States increased in capital during the decade by 62·5 per cent., and in value of products by 44·6 per cent. Slaughtering and meat packing gained 101·5 per cent. in capital, and 73·8 per cent. in the value of products. The lumber industry increased by 57·1 per cent. in capital, and by 50·1 per cent. in value of products. The manufacture of chemicals and allied industries gained 102·8 per cent. in capital, and 109·9 per cent. in value of products. The woollen industry (exclusive of carpets and rugs), increased in capital by 62 per cent., and in value of products by 75·2 per cent. The boot and shoe industry increased by 101·4 per cent. in capital, and by 76·8 per cent. in value of products. The paper and wood pulp industry showed an increase of 144·4 per cent. in capital, and 110·2 per cent. in the value of products. From 1909 to 1912, the capital of the national banks increased by 48·3 per cent.; and bank clearings reported by the leading clearing-house associations increased by 45·2 per cent. The cost of construction and equipment of street and electric railways increased by 112·1 per cent., and the gross income of operating companies by 133·9 per cent. Mr. Nicholas cannot avoid one note of jubilation. "It will be noted," he says, "how greatly the record of central stations surpasses that of any other industry." But he does not give the bases on which the percentages are computed, which prevents us joining in the jubilation. An addition of 1 kilowatt-hour to 100 kilowatt-hours is 1 per cent. increase; an addition of ¾ kilowatt-hour to ¼ kilowatt-hour is an increase of 300 per cent.! However, it is important that an industry such as that of gas supply should keep a close eye on the development of other industries, and to investigate whether in the developments there is scope for its own business expansion, instead of waiting for this to come automatically, with undue delay and irregularity.

New Conditions and Tariffs.

Something is also said in the article as to the making of rates for electricity supply. Mr. Nicholas remarks: "The foundation of an adequate level of earnings is rate-making controlled by scientific investigation, and directed with mathematical regard for all of the considerations involved in changes." We should like to see what sort of case could be made out for the rateable value system, as exemplifying a method of charging "controlled by scientific investigation, and directed with mathematical regard for all of the considerations involved." In this country, the future demands a benevolent latitude in respect of the "mathematical regard." Apparently, Mr. Nicholas thinks the same of America; for he observes that "the consideration to be faced now is the important one that some of the conditions which have been controlling in the past may not be found in the future." This is true. With capital dearer, labour dearer, coal and oil dearer, materials generally dearer, and plant and appliances dearer, tariffs will claim a new foundation; for it is certain that, save in some specially well-favoured areas, reduced generating costs through improved machinery are not going to compensate for all the additions to outgoings which have been imposed by the changing conditions in the world.

Eye Troubles.

In the same American organ, Mr. M. Luckiesh has an article founded on an inquiry he has made into the cause of eye fatigue, the results of which inquiry are far from conclusive—in fact, the investigator confesses as much. Many people, he says, have taken it for granted that eye fatigue is due to the absorption of radiant energy—visible and infra-red—in the eye media. In experimenting upon this matter, Mr. Luckiesh considered it possible to determine experimentally the effect of energy absorption by surrounding an ordinary incandescent electric-lamp with a water-bath, or other solution transparent to visible rays, but practically opaque to infra-red rays, and ascertaining whether or not the eyes are fatigued as much when used under this low energy illumination as under the illumination containing all the original energy unaltered in wave length. What the views of Mr. Luckiesh are after his investigation are indicated by the statement that, "Sunlight, owing to the greater intensities encountered, appears to be probably as effective in producing cataract and eye fatigue as ordinary artificial illuminants, even after allowing for the higher luminous efficiency of the former, and the absorption of energy by the water vapour present in the atmosphere." At the same time, the inquirer does not claim that the data in the article settle the question of the influence of energy absorption in the eye media. Anyone would have been prepared to say the same thing; for the proper quarter in which to look for the real settlement of the question is not by research of this nature, but in the consulting rooms of the ophthalmic surgeons. The testimony that has issued from these quarters is that since high intrinsic brilliancy electric-lights have come into use, and where such lights are employed, eye troubles have greatly increased.

Costly "Fires" for Winter.

With the approach of winter, the makers of electric "fires" for room-heating are busy advertising their wares, and having them described in the electrical papers. There is something exceedingly artificial looking about these new "fires." But the manufacturers are doing their utmost to make them as near as possible appear like the popular gas-fire of modern form; and they are meeting with some amount of success. They cannot, however, manage closer equality in that paramount essential—high heating efficiency at low cost. The lamp form of radiator is old-fashioned. There are heating elements now—which are the equivalent of the "fuel" or the "radiants" of the gas-fire One of the manufacturers—the firm producing what are known as the "Quead" fires—state boldly that they have not hesitated to benefit by the years of experience of the authorities in domestic heating in the worlds of gas and coal; and they have adopted radiant heat. We are much obliged to them. They have no only adopted radiant heat, but fireclay as the base for their new elements; and using this, we are told, there is no trouble with the resistance wire when at red heat. The fireclay bars are o D-shape, run horizontally, and deeply grooved from top to bottom the wires being placed in the indentations. When in use, the wire become incandescent, and the heat is transmitted to the fireclay We can see these bars of fireclay absorbing a lot of heat, which cannot all be accounted for in a frontal direction as radiant heat In the "Revo" fires, made by another maker, there is also a ba of fireclay with concave face, on which is run the resistance wire In this case, the makers prefer the fireclay not to act as a conductor of heat from the wire more than is necessary. Their firecla bars have smoothly polished surfaces; and space is left betwee the fireclay and the wire, so that the former is said to be kep "comparatively cool." In the Ferranti fires, the resistance wir is wound on to a grooved spiral porcelain cone. In the Bastia fires, the resistance material is used in combination with quart but the makers of Bastian goods do not appear to think much the knowledge of other makers. They claim that Bastian heate (so we read in one of our electrical contemporaries) are free fro the troubles that arise with many high temperature heaters place on the market without sufficient knowledge by the makers as the conditions to be met with in practice. Let other makers electric-fires bow down before superior knowledge. The make of the Bastian types say that there must not be the slightest trac of iron in the resistance alloy; otherwise there may be chemic action at high temperatures, and presumably disaster. In th various makes of fires, one or more elements are used, up to (say six; and where there is more than one element, there is more tha one switch, so that there can be fixed heat control. The element in the different makes are variously rated at from 600 to 1000 watt per hour; so that on cold days when three, four, five, or six time those loadings per element are required, the expense will sho

) at remarkable speed. The makers of the "Quead" goods re- ommend that "fires" of ample capacity should be installed in all ises, so that a good reserve is available for emergencies. The lvice is very necessary; but, oh, the cost in cold weather! The .me makers advise that from 1500 to 2000 watts heating capacity iould be installed for each 1000 cubic feet of space to be heated. sers of electric fires find that this is not an over-estimate. Still iitating the types of gas-fires, we see that some of the new elec- :c ones are made with cast-iron casings for permanent fixing in esent fireplaces; and there are also "dog-grates," and "insets" after the manner of gas-fires. There are also portable fires; id fires with very flimsy casings, which have not much about em suggesting permanence.

Nominal and Horizontal Candle Power.

The question whether the purchasers of electric-lamps should merely be told the wattage, without an indication of the candle power or efficiency has not yet reached any definite settlement, and never ll while there are people who, while admitting the brazen- :ed electrical exaggeration of the past as to lamp perform- ce, object to consumers having no information vouchsafed to ɜm which will guide as to the light that a lamp will actually ord them. In Germany (as well as in America) some of the .ncipal electric lamp people, as we have previously stated, ɜ in favour of the wattage rating. One prominent company— ɜ Siemens-Schuckert—advertising in the "Electrotechnische itschrift," put forward their views in favour of wattage rating, t at the same time they still quote the mean spherical candle wer. Pointing out that the candle power of both carbon and tallic filament lamps is generally measured in the horizontal ection, they say, since the light emission of these lamps is less all other directions, the true candle power (mean spherical) about 20 per cent. below the nominal value. This is a con- erable variation from the reputed performances of the lamps. tting the rating in watts, and giving as well the spherical idle power, the Company in question say this will permit the isumer to calculate for himself the total operating cost of a ip per hour of lighting on the basis of the established price of ilowatt-hour. The confessions of past deception have come y tardily from the electricians; but now that they are making ifession, they are doing so thoroughly. It would ill-become not to give them credit when credit is due.

The Miners Object.

The official report on fatal electrical accidents in mines during 1914 states that there were only nine (some of them due current at voltages of only 220 and 300), which is an improve- nt. There were sixteen reported deaths in 1913. The miners, wever, are restless over the matter; and they are fully per- ided that these official returns only touch the fringe of the tter, and that certain of the terrible colliery disasters, involving appalling sacrifice of life, have been electrically produced. At recent Miners' Federation conference, a resolution was passed favour of securing by legislation, the abolition of all electri- ly coal-driven machinery in mines; the miners believing that s would relieve them of a serious menace. It was thought that suggestion being limited to coal-cutting machinery did not go enough; and so, in remitting the resolution to the Executive mmittee, power was given to them to widen its scope. There indications that this has become a very acute question be- ɜen owners and men. Example was provided at the meeting hort time since of the Midland Institute of Mining Engineers. e subject under discussion was compressed air machinery; and ranspired that in some instances compressed air has super- ed electricity in mines—not on account of greater economy, apparently to quieten the men. Economy is not the impor- t consideration where there is any question of risk to life.

CONTINUOUS METER-READING.

e October issue of the "Monthly Bulletin of the National nmercial Gas Association of America" contains an article, ler the above title, by Mr. R. C. JAMES, a member of the Ac- nting Committee of the Association, in which he explains that system known as "Continuous Meter-Reading"—so called by son of the fact that a portion of the meters are read each day ɔughout the month—has been used by many of the larger gas ıpanies for some time, and is worthy of the consideration of ıller companies.

'he object of continuous meter-reading is the elimination of peak-load condition in the work of a company's employees at ertain period of the month. The plan consists in reading a tion of the consumers' meters each day, taking the entire city rotation, thereby keeping the meter-readers continuously at 'k reading meters, and the office force continuously at work in ting the readings through the office records and in billing.

'he congestion which occurs every month where the meters are d in as few days as possible towards the end of the month is arent, not only in the office, where the work is put through the ɔrds at forced pressure, but in the unsatisfactory service rded the consumers towards the close of the discount period. en there is but one discount period, increased work is thrown on the distribution department by reason of consumers waiting until they visit the office to pay their bills before turning in complaints and orders. These conditions are offset by continuous meter-readings, as all transactions between the company and its consumers, beginning with the reading of the meters to the collection of accounts, are distributed evenly over the month.

Among the various ways in which the system is helpful to a company, the following are mentioned. The number of meter-readers may be reduced. By being engaged upon meter-reading altogether, the men become expert; and their capacity for reading a larger number of meters soon increases. There is greater accuracy in reading, thereby reducing the number of complaints about incorrect bills. It eliminates the possible necessity of drawing upon the distribution department several days each month, for men to assist in meter-reading; and by permitting these men to be profitably engaged in executing orders, it promotes the efficiency of the company's service to consumers.

With some companies, not only will it effect a saving in the cost of meter-reading, because of the fewer number of meter-readers, but an additional reduction may result by reason of the fact that distribution or other men called on to assist in meter-reading are sometimes paid a higher rate than regular meter-readers.

The office and accounting force are enabled to work steadily throughout the entire month in billing consumers and receiving money. The accounting force, being relieved of the forced pressure of getting their work through in the shortest possible time, find more time to consider the work—particularly consumers' accounts with respect to over and under reads, non-registering meters, &c.—and make fewer errors. The necessity for overtime is also materially lessened.

The public is better cared for in its dealings with the company. The congestion, when only one discount period is in effect, taxes the facilities of a company to the utmost; but where continuous discount periods are observed throughout the month, congestion is eliminated, and the consumers are served in a much more satisfactory manner. By having several discount days, consumers are spared the annoyance of having to stand in lines; and by reason of such complaints as are made being heard by a fewer number, the idea of a complaint is not so apt to communicate itself to other consumers.

It spreads the work of the distribution department over a wider period, enabling them to attend more promptly to complaints which develop when consumers are at the office paying bills.

It allows the company to get in its collections much sooner, as the money is coming in continuously during the month, and permits the early use of the money. Collections can be kept up to a closer point, as bills are usually considered delinquent if not paid by the last discount day; and as the discount days would occur several times during the month, the necessary steps for getting after delinquents could be more promptly disposed of, and be given greater consideration.

After thus referring to the advantages of the system, the author said it would be well to consider the steps necessary in making the change to continuous reading. A company reading its meters as near the last day of the month as possible, and desiring to change over to continuous meter-reading, would find it advantageous to have the territory divided into districts, allotting to each district the number of meter-readers necessary to read the meters in that district. The number of meters for each district may vary, due to the density of population or building conditions —such as apartment houses and similar buildings, where meters may be arranged in batteries.

In rendering bills to consumers where a discount is in effect, and the city has been divided into districts, the discount days for the districts can be arranged to fall on different dates during the month—such as the 10th, 15th, 20th, and so on; or where bills are rendered continuously during the month, provision may be made (on the bill) to the effect that the discount will be allowed for ten days after the date of its presentation, or that no discount will be allowed after a certain date as specified on the bill—this date to be so considered that ten days shall have elapsed between the time of delivery of the bill and the last discount day.

Attention is particularly drawn to an important fact not to be overlooked when a company now reading its meters at the end of the month contemplates changing to continuous reading—namely, that it will defer indefinitely a certain amount of its revenue. If meters are being read from the 20th to the 25th or later, and then arbitrarily read continuously, it will reduce the revenue for the year anywhere from ten to twelve days, as in the year's statement where continuous readings are started there will be a whole year's operating expenses included, but only about 353 or 355 days' revenue.

Another matter which might be pointed out in connection with the change to continuous reading would be the apparently large amount of gas unaccounted for during certain periods. Should it be desired to determine the actual "unaccounted-for gas" for comparative purposes, it may be ascertained by determining the average or focal date of statement taking. The foregoing has referred generally to places with a discount period, the author concludes, but will apply equally well to a flat rate situation.

Illuminating Engineering Society.—The first meeting of the new session will take place at the Society of Arts, on Tuesday, the 23rd prox., when a discussion on the first report of the Departmental Committee on Lighting in Factories and Workshops will be opened by Mr. Leon Gaster.

BRITISH COMMERCIAL GAS ASSOCIATION.

Fourth Annual General Meeting.

LAST Tuesday afternoon, the Fourth Annual General Meeting of the Association was held in the hall of the Royal Society of Arts, John Street, Adelphi, W.C.—under the presidency of Bailie THOMAS PAXTON, J.P., of Glasgow. The same conditions ruling, the proceedings, as last year, were of a brief character; the business being a short address by the President, the consideration of the annual report and accounts, and a proposal that members of the Executive and General Committees (who would otherwise have retired) should remain in office. In spite of all difficulties, many of the members present came from far afield—a fact which demonstrates the keen interest taken in the work of the Association.

NOTES ON THE PROCEEDINGS AT THE ANNUAL MEETING.

Modest in Numbers—Representative in Influence.

THERE were, roughly estimated, some eighty representatives of the gas undertakings and firms subscribing to the British Commercial Gas Association at the meeting, at the Society of Arts, last Tuesday afternoon. The proceedings were almost formal. There was nothing in the nature of conference; the whole object of the gathering being to confirm what had been done during the Association year, and to (so to speak) sanction the continuance of the operation of the organization's machinery in the same healthy and fruitful way as heretofore. But more or less formal though the proceedings were, there were hand shakes with men from across the Border, from the North of England, from the Midlands, from Down South, and from the Eastern Counties and from the Western; so that those present were territorially representative. On the platform were the President (Bailie T. Paxton), the Chairman of the Executive (Mr. F. W. Goodenough), and the Secretary (Mr. W. M. Mason). The Editor of the Association's publications (Mrs. M. A. Cloudesley Brereton) was there. So was the President of the Institution of Gas Engineers (Mr. John Young); and not far from him was the Chairman of the Society of British Gas Industries (Alderman F. Templer Depree). Mentioning Bailie and Alderman, reminds how well municipal and company administration synthetize in this Association—thus demonstrating how common aims unite men. Aldermen were plentiful though the gathering was small. Glancing away from the central figure on the platform, within range of vision were to be seen Alderman William Kay, of Manchester, Alderman F. S. Phillips, of Salford, and Alderman W. Armitage, of Doncaster, and (as said) Alderman Depree. There are strength and influence in these names. It was a matter of sincere regret that Sir Hallewell Rogers, of Birmingham, the successor of Bailie Paxton in the presidency, was unable to attend; but, all being well, we shall see more of him during his year of office.

Presidential Impressions.

An address from the President was the only departure from the business formality of the occasion. It was short; it was a sample which satisfied that, as commercial man and as the late Convener of the Gas Committee of the Second City of the United Kingdom, the President would, had the opportunity been propitious for the reception of the Association in Glasgow, have given an address that would have had a projecting interest in the Conference records of the Association. And in the substance of the address was a dash here and there of the best brand of dry Scotch humour. The members were all sorry that the war and its disturbing influences prevented the holding of the meeting in Glasgow; and the disappointment was equally that of our Glasgow friends. But the British Commercial Gas Association has not yet allowed the word "failure" to be deservedly applied to its proceedings; and there was the fear, generated and warranted by the circumstances of the times, that in point of numbers, if not in enthusiasm for the cause, the meeting would not have been all that would have been desired.

This paragraph is side-headed "Presidential Impressions," which, however, is not quite correct. The impressions were largely formed before Bailie Paxton was elected two years ago to the presidential chair; and they are in reality the cause of his appearance in the presidential chair. He and his colleagues were persuaded as to the value of the work of the Association (and so, we know, was Mr. Alex. Wilson, the Gas Engineer and Manager to the Corporation); and they were also satisfied with the conduct of the Association's affairs. Had they not been so, "they would not have become, as they are, regular subscribers on the full basis—a good test of any man's faith, and not least perhaps of a Scotsman's." Whereat there was laughter; for if liberality ever had good exemplification, Glasgow can, without fear of dispute, claim to have given it. From satisfaction, the belief in the organization has become deeply rooted. The President was glad of the opportunity to pay tribute to the united good work of the Executive Chairman, the Editor, the Secretary, the Advertising Agent, and the Committees—they all deserved it. Then he readily transferred himself to that ancient subject—the value of co-operation. There are many tests of sanity; but accepting "the capacity to co-operate" as such a test, the President had the gratification of acknowledging that those directing the 80 per cent. of the gas business who are subscribers to the Association are pre-eminently sane, and he is satisfied that those representing the 20 per cent. are far from being incurables. There are exceptions which show that the test applied is not always a valid one. The cooperation, for instance, of Germany, Austria, Turkey, and Bulgaria, does not by any means attest sanity. However, the President is looking to seeing not many years hence a subscribing list representing the 100 per cent. line of the gas industry. When he consults the list of subscribers, and sees the cities and largest towns expressing through financial support their confidence in the organization and its work, and when he inspects the membership list of the Society of British Gas Industries—all hard-headed business men—he fails to find a reason for there being any undertaking associated with the gas industry standing outside helping to form a group of non-subscribers. Apart from the advancement of the prosperity of the gas industry, the work the Association is doing is one of social value; for educating the public in (among other things) cooking, domestic and industrial heating, and water heating, good is being done in diminishing the foulness, noxious and destructive, that is sent into the atmosphere through the crude modes of heating by raw coal. Mr. Goodenough during the proceedings also had something to say about continuing the efforts to bring the subscribing force up to the possible maximum; and Alderman Phillips is optimistic enough to believe, from an experience he has had, that if the Association does not give in, the non-subscribers will do so. We hope they will not do so merely for the purpose of getting rid of importunity. The best subscriber is the voluntary one, or the one who has been fully persuaded that a cause merits his support. Those who come in against their will are the ones who are likely to be always looking out for some reason for escaping from the obligation to subscribe.

Confidence, Satisfaction, and Work.

The best certificate the subscribers could give of their confidence in, and satisfaction with, the Association was furnished by the report and accounts. If during the war, and in the circumstances created by it, there had been some disposition to fall away from the organization and its cause, there would not have been much ground for surprise; but the contrary is the fact. It was very gratifying to those present to hear the point emphasized by Mr. Goodenough, when moving the adoption of the report and accounts. From gas undertakings, the income of the Association amounted to £582 more than in the preceding year; and the names of 39 additional gas undertakings were entered on the roll. This is very encouraging to the active workers, who have had since the war started a time of considerable anxiety. Votes of thanks are nice and acceptable; but there is to the officers a fine intrinsic value about the foregoing figures. They betoken much; and they tell the workers more than words can do. The Society of British Gas Industries were behind in their subscriptions; but it was the pleasure of Alderman Depree to announce a material addition to the item standing to the credit of the Society in the printed accounts—raising it from £1365 to £2016. The work of the year has been fully maintained; but its ramifications do not constitute a matter about which to talk in detail—one might just as well give away all the details of the transactions of a business establishment. But the workers in the organization are opportunists, and they are unashamed of the *rôle*. They have been taking advantage of the pressure for war material to push into notice the advantages of the industrial uses of gas; they have been making known the value of gas for warming and for hot water supply in the hospital and the sick room; and they have been helping authority, and with large success, to appreciate the value of gas in catering for the inner requirements of the units of our great Army and Navy. There has been advertising in all the main channels by which the public eye is captured; there has been continuity in the production of literature; there has been a constant stream of service to the subscribers; and there has been research into different questions. In the offices of the Association is found a highly organized system; and there is no time to waste there. Plans for the future contemplate the application of some of the energy in new directions.

A Homily on Advertising.

From all this it will be seen that it was a good and satisfying report that Mr. Goodenough had to present. His remarks were much to the point. They also incorporated a little homily on the subject of continuity in advertising, which had appropriateness in more ways than one, inasmuch as the speaker has had a large experience in advertising through both the Gas Light and Coke mpany and the Association, and he was addressing men some whom—the members of the Society of British Gas Industries iecially—are advertisers of varied degree. The point was .de by him in support of continuity of effort in the work of the sociation; and what he had to say has our complete adherence. was simply this, that lapse in advertising is not a good thing. is a matter that has not sufficient place in the rules of business iduct of some of those who trade with the gas industry. From experience of large advertisers, Mr. Goodenough draws the ormation that, when there is lapse in advertising, a consider- e amount more has to be subsequently spent in recovering m the bad effects created by the lapse. This being the case, re is not economy in the lapse, but something just the contrary. ien, too, readers see—and, mark this, there are many observant tics in the gas supply industry—that there is collusion in the iods of lapse in advertising, they naturally ask themselves ether there may not be collusion in other matters. The point de by Mr. Goodenough we have previously put forward in ation to the discontinuance of a few gas undertakings of busi- ss in the connecting-up of fresh gas appliances during the war. are certain that this policy is not a beneficial one—that, eed, it means the undoing of much of the good work accom- shed before the war, and that, when there is a resumption of siness, a long length of the road already travelled in effecting development of business will then have to be retraversed. d this all through the cutting-off of new business because the intry is at war.

the New Year with Confidence.

Iowever, there was little else specially noteworthy. The re- ng of members of the General and Executive Committees was stponed until the annual meeting next year. The zealous rk of all and sundry for the Association was duly acknow- ged; and the members then confidently turned to the new r's work, which is to be carried on under the presidency of Hallewell Rogers, who, like his predecessor genial Bailie xton, has been one of the strongest sympathizers and upholders this piece of highly successful co-operative work.

GENERAL REPORT.

The PRESIDENT [rising amid loud applause] proposed that the nutes of the last meeting be taken as read.

APOLOGIES FOR ABSENCE.

The SECRETARY (Mr. W. M. Mason) then announced that he d received apologies for absence from the Lord Provost of inburgh, the Lord Provost of Glasgow, Sir Corbet Woodall, Hallewell Rogers, Sir Daniel Ford Goddard, Sir William H. ephenson, Mr. D. Milne Watson, Alderman Redfern, Mr. R. J. ville Neville, M.P., Mr. John Bond (Southport), Mr. H. Wade acon (Liverpool), Bailie J. A. Lindsay (Leith), Mr. C. Stafford ery (Bath), Mr. C. E. Dovey and Mr. George Clarry (Cardiff), Dr. H. Harris and Mr. W. N. Westlake (Exeter), Mr. J. D. Smith lfast), Mr. R. Beynon (Torquay), Mr. H. Kendrick (Stretford), . W. H. Bennett (Redhill), Mr. J. W. Auchterlonie (Cambridge), . Charles Clare, and Mr. H. James Yates.

BAILIE PAXTON'S ADDRESS.

The PRESIDENT remarked that the next item on the *agenda* was address by the President. This address would not be very portant; neither would it be very long. He proceeded to read following

PRESIDENTIAL ADDRESS.

'ellow members,—It was a very great disappointment to me l to the Gas Committee (indeed, to all the members) of the rporation of Glasgow, which I have the honour to represent, en a year ago the war necessitated the cancelling of the con- ence which the Association had arranged, at the invitation of isgow, to hold in the city. At that time we all hoped that the nt was only postponed for a year, and that this October we ght be assembling to digest papers and speeches—and other tters perhaps a little less dry—in the Council Chamber, and und the social board, in what we are proud to call the Second y of the United Kingdom.

But "the best laid schemes of mice and men gang aft agley;" d so, thanks to the obstinacy and magnitude of this terrible siness which we would all so gladly have seen finished ere this it only finished—as we mean to see it is finished—with the com- te discomfiture of the enemies of civilized humanity), here I am day delivering my valedictory address as President without ving had the happiness of welcoming across the Border the at assembly of your members in conference, and showing you we think of the Association in Glasgow.

It was only in the hope and belief that the deferred meeting uld be held in Scotland this autumn that I accepted the presi- ncy for the second year upon being urged to do so by the Com- ttee; and it is the very greatest disappointment to me and to asgow that this hope has fallen to the ground. The circum- nces being what they are, however, no course was open but that ten by the Committee, with the full concurrence of their would- hosts—namely, to abandon yet again any idea of a national nference, and to hold in London the annual general meeting required by our constitution for the purpose of transacting the necessary formal business.

While we all felt that it was imperative that the Committee should remain in office until the happy day arrives when a national conference can be held and the normal course of events can be resumed, I also was strongly of opinion that it would be in the best interests of the Association that I should, without further delay, hand on the honour of the presidency to the representative of another great city on the list of subscribers. I felt, however, that I could not lay down that honour, which I, your first "elected" President, have deeply appreciated, and for which I thank every member most sincerely, without putting on record in a brief address my firm belief in the value—aye, in the undoubted necessity—of this Association to the gas industry, and my opinion, based upon two years' close observation and first-hand experience, of the way in which its work is being done.

I do not propose to touch upon the detailed records of the past two years. They are to be found in the reports of the Committee, or in the pages of the "Bulletin," and will be referred to by Mr. Goodenough in presenting the report and accounts. What I want to do as briefly as I can is to record my own impressions as your retiring President. Before I took office as President, I was, through my membership of the General Committee for nearly two years, persuaded of the value of the Association's work and satisfied with the conduct of its affairs. So were my colleagues of the Corporation of Glasgow, or they would not have become, as they are, regular subscribers on the full basis—a good test of any man's faith, and not least perhaps of a Scotsman's. But after my two years' intimate acquaintance with all the details of the organization, with the many important services, direct and indirect, rendered to the industry, and with the spirit animating the Committees and officers, my persuasion has become deep-rooted belief, and satisfaction has grown to full-hearted enthusiasm.

I have been particularly struck during my period of office by the business-like conduct of all the Association's affairs, by the constant freshness of policy and ideas put forward, by the alertness to note, and the ready initiative to deal with, new situations as they arise—such, for example, as the relationship of gas to the munitions problem and the thrift problem—and, withal, by the keenness and enthusiasm animating all concerned. No one, in my opinion, could be more zealous and enthusiastic, yet prudent and sound, than our Secretary, who, you must not forget, came from Glasgow, where we are proud of him. The originality, knowledge, skill, and industry of our Editor are steadily becoming known to all of you, but can only be fully appreciated by those on the Committees. The competence and artistic ability of our advertising experts have advertised themselves, and established for the Association a high place in the circles where publicity is criticized professionally. And, finally, there is, under the sound generalship and constant inspiration of our Executive Chairman the splendid spirit of harmony—not necessarily of opinion, but of aim and intention—that has so much impressed me at all meetings of the Committees.

These Committees, comprised of keen business men, representing undertakings (small, medium, and large) in all quarters of the country, discuss thoroughly all the considerable volume of business brought before them month by month and quarter by quarter, with but a single purpose—the good of the industry—and without the slightest sign of personal or district or trade jealousies or any of the other discords that mar so many committees and councils. The gas industry has indeed, in my judgment, much cause to be proud of the success of this great effort of co-operative enterprise, which entails not merely harmony of ideas but the severely practical harmony involved in the pooling of large sums of money to be spent for the general good.

It has been said that "the capacity to co-operate is a test of sanity." Well, it is evident that the great body of the gas industry is pre-eminently sane—and, to judge by the steady inflow of new subscribers, even during this exceptional and trying period, the comparatively small balance are far from being "incurables." I must say that I cannot conceive that any gas committee or any board of directors could possibly remain outside or hesitate to give full support if the members did but once realize what is being done by the Association for them and for every other gas undertaking in the country.

That it is not indifference to, but ignorance of, the work that is being done which prevents those outside from coming in is, I think, clearly demonstrated by the fact that, so soon as the chairman of any undertaking comes to a conference of the Association, whether district or national, and learns the facts, he becomes a keen supporter, and does not rest until he has persuaded his fellow-councillors or directors. I have therefore every faith that before many years are past every gas-works in the United Kingdom will regard its *pro ratâ* subscription to the British Commercial Gas Association as being as necessary an item in the expenditure account as that for coal or wages—a subscription, be it remembered, representing only one penny—just the cost of a postage stamp—per consumer per annum. I am not going, unless I am compelled, to believe that any councillor or director or manager will consciously and wilfully let his undertaking benefit from this co-operative campaign without paying its share of the cost. So I just ask all those who have not yet joined us to consider these facts.

In the past four years nearly £100,000 has been subscribed and spent upon publicity work for the gas industry in these islands (and beyond); and the amount is growing steadily. It has not been subscribed light-heartedly or for the sake of getting rid of superfluous money. It has been paid out by the experienced and cautious business men of every capital and every leading city in the kingdom. Just look at the list: London, Edinburgh, Cardiff, Dublin, Glasgow, which is not generally credited with prodigality, Manchester and Salford, where the first conference definitely established the Association's place in the industry, and whose rulers know the value of a sovereign at least as well as most, Birmingham, whence we welcome heartily our next President, Sir Hallewell Rogers—one of the ablest of the many able business men in that enterprising city, Liverpool, which mourns the loss of my much-esteemed predecessor in this chair, Belfast, Newcastle, Bradford, Leeds, Sheffield, Hull, Derby, Leicester, Norwich, Portsmouth, Plymouth—the list could be extended until it covered more than 80 per cent. (by volume) of the whole of the gas industry.

Why have the 500 undertakings on our list of subscribers, and the members of the Society of British Gas Industries who have loyally backed them up, put up this big sum of money if it is not because the hard-headed business men directing them realized that there was, and is, a great, a profitable, and a good work to be done in popularizing the use of gas that could only be done effectively and economically by joint effort; and that if the right organization could be established for the work it was the bounden duty of all to contribute their share to the cost?

I have spoken of the popularizing of the use of gas as a good work, and I so regard it, apart from any question of profit to the supplier, because I am a staunch advocate, as indeed is every member of the Corporation of Glasgow, of the effective abatement—if possible the abolition—of that curse of every modern town and city, the smoke nuisance. It is because I believe that this Association is materially helping us to dispel the pall of gloom which, wreathed out of the waste of our national coal resources that pours out of our myriad domestic and factory chimneys, cuts off the sunshine from our streets, destroys our vegetation, undermines the health of our citizens, and depresses the vitality of our workers—it is especially because of this that I give the Association not only my support as a business man, but my blessing as a member of the community, and with all the earnestness of which I am capable urge its claims to whole-hearted support alike upon those who are already on the list of subscribers, that they may continue and increase their contributions, and upon those who are still waiting to be convinced, that they may at once come forward and join hands with us in the work that waits to be done.

THE REPORT AND ACCOUNTS.

The PRESIDENT said that, his rather trying ordeal being over, he had now to call upon Mr. F. W. Goodenough (the Chairman of the Executive) to present the report and accounts.

The report was as follows:

The General Committee present to the members and associate members and to the administrators of the undertakings and firms subscribing to the Association their fourth annual report and statement of accounts. To make it possible to issue the report and accounts duly audited to the members before the annual meetings, the Committee decided (as announced in the "Bulletin" for April, 1915) to make up the accounts for this and each succeeding financial year to Aug. 31, instead of Sept. 30. Accordingly, the accounts now submitted are for a period of eleven months.

POLICY DURING WAR TIME.

The members present at the annual general meeting held in October, 1914, authorized the Committee to proceed with their publicity work in unabated measure during the year, paying special regard in the details of the campaign to the abnormal conditions prevailing in both industrial and domestic life. The policy thus authorized was subsequently endorsed by the boards and committees of the supporting undertakings in the most practical manner possible—namely, by providing the necessary funds for its pursuance. The evidence of this continued support is seen in the accounts, from which it will be noted that the income from gas undertakings during the eleven months shows an increase of £582 over that in the preceding year. The Manchester Gas Committee, it may be mentioned, gave valued evidence of their appreciation of the work of the Association by passing a resolution to renew their subscription for a further three years certain.

INCREASE IN NUMBER OF SUBSCRIBERS.

What is equally satisfactory—and, under the circumstances, exceptionally gratifying—is the fact that no less than 38 undertakings (including several important municipal gas departments) have been added to the list of subscribers since Sept. 30, 1914—several of them quite recently. The work of the District Membership Committees, which have been formed during the year, and have commenced active operations already in some districts, has contributed materially to this good result—notably by the meetings at Blackburn and Birmingham. When it is possible to resume the holding of District Conferences, which have had to be suspended during the war, it is confidently hoped that the activities of the Membership Committees will bear further fruit.

The output of the subscribing undertakings now represents more than 80 per cent. of the entire gas industry of the British Islands.

THE SOCIETY OF BRITISH GAS INDUSTRIES.

The financial support received from the manufacturers of gas plant and appliances during the eleven months has been very disappointing. It is hoped that this year the deficiency in the contributions* received through the Society of British Gas Industries in 1914-15, as compared with former years, will be made good, in addition to an increased contribution being forthcoming for the year 1915-16.

PROPOSED ADDITION TO THE EXECUTIVE.

In view of the increasing number of subscribers, and for the purpose of ensuring adequate representation of the various districts on the Executive Committee in proportion to the income received from each district, the Committee recommended that rule 10 be altered so as to read:

10.—(*a*) The Executive Committee shall . . . consist of twenty-one members made up as follows:—

(1) The President and first Vice-President (*ex-officio*) and eighteen members to be elected by the General Committee from amongst the members of that Committee, but so that four of them shall be members of the Institution of Gas Engineers and three of them shall be members of the Society of British Gas Industries; and

(2) The Honorary Treasurer, *ex-officio*.

In electing the eighteen members aforesaid, the General Committee shall have regard to the total subscriptions received from each district.

(*b*) A Chairman and Vice-Chairman shall be appointed from time to time by the members of the Executive Committee from among themselves, and shall retire at the meeting next following the annual general meeting, and shall be eligible for re-election. At the first meeting of the General Committee after each annual general meeting six members of the Executive Committee shall retire, and shall be eligible for re-election.

If these alterations be adopted, the districts will be entitled, on the basis of present contributions, to the following representation:

District.	Representation on Basis of Subscriptions.	Representation as at Present.
Eastern	1	—
Ireland	1	—
Manchester	3	2
Midland	2	2
Northern	1	1
Scotland	1	—
Southern	5	5
South-Western	1	—
Wales	1	—
Society of British Gas Industries	3	3
Ex-officio—		
President	1	1
First Vice-President	1	1
	21	15

THE WORK OF THE YEAR.

It will be seen from the accounts that, after providing the expenses of administration (which have, as formerly, been kept below 5 per cent. of the total), and paying off another £1000 in respect of the National Gas Exhibition deficit, leaving a balance of £1325 still to be paid, there has been spent on publicity in the eleven months the sum of £15,186, or slightly more than in the preceding twelve months. The publicity work done during the year has included an active and very productive campaign in the technical as well as general press for extending the use of gas for industrial purposes (especially for the manufacture of munitions); an educational campaign directed to interesting teachers in the manufacture, distribution, and application of gas as subjects for lessons to their pupils; and advertisements and articles in all branches of the press, emphasizing the value of gas in the sick room and hospital, and pointing out the many ways in which gas can assist all classes of the community to practise economy in war time.

The special character of the work has entailed the distribution of large quantities of literature—particularly copies of "A Thousand-and-One Uses for Gas," "Teachers' Notes of Lessons," and "Simple Cookery for the People"—as well as the preparation of a great deal of literary matter in the editorial department, the activities of which have been considerably extended during the year, with excellent results. The correspondence that has been received, and the business that has accrued from the inquiries made, as a result of the publicity work of the year, have shown that the work has been done on the right lines, was well worth the money spent, and has laid a foundation for much additional business alike in the near and in the distant future.

ADVERTISING LITERATURE.

It will be noted that the statement of the production, sale, and distribution of the Association's literature has been treated separately in the accounts this year. It was felt that this change would make for greater clearness. The sales of literature during the eleven months show a considerable falling-off compared with other years, owing to some managers suspending purchases during the first few months of the war. The sale is reviving now that it is generally realized that the advertising of a money-saving and labour-saving commodity is distinctly timely in the present crisis; but the Committee still feel that much greater use might well be made of the excellent advertising material the Association puts at the disposal of its subscribers.

ASSISTANCE RENDERED TO SUBSCRIBERS.

A steadily growing side of the Association's activities is that to which reference is from time to time made in "The Bulletin," under the heading of "Assistance Rendered." In ever-increasing measure the hope of the founders of the Association is being fulfilled, that it would become a bureau of information, advice, and assistance in regard to all matters relating to the commercial side of gas supply. The records of assistance rendered to subscribing undertakings which periodically come before the Committee show that, in connection with problems and difficulties which arise in their districts, members are constantly seeking and obtaining help to an extent that proves clearly the need and value of the Association.

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* Since the closing of the accounts for audit, the Committee are informed that a further substantial sum will be contributed by the Society in respect of the past financial year.

RESEARCH WORK.

Mention may be made specially of assistance rendered in connection with questions raised by factory inspectors, and of the practical research work done on such points as the alleged effect of gas heating on pianos, the alleged fading of coloured fabrics through the use of gas lighting, the alleged injury to organs and to mural paintings through the use of gas, and the alleged effect of gas products upon leather—the result being in every case completely to exonerate gas from blame, and to determine the true cause of the trouble.

WORK FOR THE FUTURE.

Other work that is in hand includes the consideration of the relations between the gas industry and the plumbers and ironmongers, the preparation of a handbook on the uses of gas for the information of the consumer and especially of architects, research upon the colour-values of various forms of light, and an inquiry into various methods of recording costs and keeping accounts in connection with the sale of gas.

THE ELECTION OF PRESIDENT FOR 1915-16.

The Committee have pleasure to report that Sir Hallewell Rogers, .P., the Chairman of the Birmingham Corporation Gas Committee, has consented to be nominated for election as President for the ensuing ear. It may be mentioned that the General Manager of the Birmingham Gas Department (Captain R. S. Hilton), who is a member f the Executive Committee, is at present serving the country as Secretary to Lord Moulton's Committee on Explosives. It will be the ope of everyone that the annual meeting in 1916 may be held in Birmingham, and that the signing of Peace after Victory may have by hen allowed Captain Hilton to return unscathed to his work in the ndustry.

VICE-PRESIDENTS.

Since Sept. 30, 1914, one Vice-President has retired (Alderman T. mith, of Leicester), and one (Colonel Oakden Fisher, of Cardiff) has, o the great regret of the Committee, been lost by death, while the ollowing have been elected: Alderman T. Canning (Newport), Councillor George E. Hilton (Leicester), Alderman A. Nuttall (Blackburn), nd Councillor T. Quinney (Coventry).

THE LATE MR. EDWARD ALLEN.

The Association suffered a severe loss in the much lamented death f Mr. Edward Allen, who was President during the year 1913, when he second annual conference was held in London at the Guildhall nd the National Gas Congress and Exhibition. Mr. Allen was one f the original and most enthusiastic supporters of the movement that esulted in the formation of the Association, the progress of which he id everything in his power to promote. He is deeply mourned by very member who had the privilege of his friendship.

INTERNATIONAL MEMBERS.

The names of all international members of enemy-alien nationality ave been removed from the register. The number of international embers now stands at 63.

POLICY FOR THE ENSUING YEAR.

The Committee strongly recommend that the work of the Association hould be prosecuted with unabated force during the ensuing year, but ropose that, in view of the difficulties that may arise in some districts supplying the normal demand for gas this winter, the publicity ampaign should be especially devoted to the development firstly of he spring and summer output, and secondly of the heating business the autumn of 1916.

Members are asked to do their utmost to maintain and increase the come of the Association during the next twelve months, as it is still r from adequate for carrying out in its entirety the productive work which so promising a commencement has been made in the past ur years.

THOMAS PAXTON, *President.*
FRANCIS W. GOODENOUGH, *Chairman of Executive.*

Mr. F. W. GOODENOUGH, on behalf of the Executive and eneral Committees, then submitted the fourth annual report nd accounts, and amplified somewhat the account therein given their stewardship. It would, he said, be recognized that the scharge of the duties had not been free from exceptional xiety in the circumstances of the past year. The Committees nd their officers had always been fully conscious of the responbility placed upon them for the just and profitable expenture of the considerable sums of money entrusted to them the subscribing undertakings; and they had been more than er conscious of this responsibility since the outbreak of war. ut for whatever time and thought they had expended upon the ministration of the funds of the Association since its inception, nd for whatever additional anxiety they had experienced during e past fourteen months, the Committees had been more than lly rewarded by the splendid support they had received in that riod from the gas industry throughout the kingdom. Concrete oofs of this support were given by the report and accounts now esented. There had during the past year been added 38 fresh mes to the list of subscribing undertakings; while another had me on since the year closed. The income from gas underkings was £582 more than in the previous twelve months—a ct which spoke for itself, and spoke eloquently. It was true at the support received from the manufacturers of gas plant nd appliances showed in the accounts a drop of £1000; but he ought Alderman Templer Depree would be able to give some assuring news on this point. Indeed, had the Society, before e accounts were audited, notified them—as, owing to a misunderanding on their part, they failed to do—that further substantial bscriptions would be forthcoming in respect of the financial ar, the Society would have been credited with a larger sum in the accounts now presented. If he might venture upon a hint as to how such trouble could be avoided in future, he would suggest that all the members of the Society should pay their subscriptions early in the financial year, instead of waiting until near, or after, its close. The Association was constantly short of "working capital," and would be glad of an earlier inflow of subscriptions —both from manufacturers and from gas undertakings. In this connection, he might say that applications sent out for a renewal of subscriptions had met with a most gratifying response. A letter had arrived that morning from Manchester saying that a cheque would be sent on at the end of the month; and a good many other undertakings had also promised remittances at an early date. They had every reason to be grateful to Manchester for the lead they had always given in this matter. What, however, he wished to emphasize now was the magnificent support received during this anxious period; and he desired to express the thanks of the Committees to all who had contributed to this result, and had in so practical a manner expressed confidence in their policy and administration. He would also, on behalf of the Committees, like to thank the President for the handsome way in which he—a shrewd business man not inexperienced in committee work in other spheres—had testified to the fact that the work of the Association was done in businesslike fashion, and that the members of the Committees laboured harmoniously together for the good of the industry. As Chairman of the Executive and Deputy-Chairman of the General Committee, he could certainly endorse most heartily all the President had said. The spirit of helpful and never destructive criticism, of true co-operation for the common good, that had animated every member and every meeting, had, together with the loyal service of all the officers of the Association, rendered his (Mr. Goodenough's) task easy and delightful. Turning to the accounts, it was not necessary for him to say much more in regard to the income side, beyond thanking the Manchester Institution and the Lancashire Commercial Section for their continued support, and explaining that the fall in receipts from foreign undertakings and international members was due to the war. A certain number of international members had been removed from the register. On the other side, expenses of administration were less than in the previous year by reason of them not including this time the cost of sending representatives to the Munich Gas Exhibition. It was fortunate the President and the Secretary got back from this expedition before war was declared. As in former years, the expenses under the heading of administration represented less than 5 per cent. of the total. In addition to £1000 contributed to the National Gas Exhibition account (which it was hoped to close during the current year), £346 was spent on the "Bulletin," the annual meeting, and the district conferences. They would like to see the expenses for conferences go up again; for these opportunities for discussion and for propaganda work had been sadly missed during the war. This left £15,116, which was increased by drawing on the carry-forward to the extent of £71 to £15,187, to spend on publicity. Of this, £774 was spent as to two-thirds in distributing literature to the public (including copies of "A Thousand-and-One Uses for Gas," sent regularly to many important officials, of notes for lessons sent to teachers, and of other pamphlets usefully distributed), and as to one-third in providing playing cards and matches for the troops. Of the other £14,413, over 40 per cent. was spent upon publicity—carefully planned to meet the special circumstances of the day, alike as regards their industries, public services, and homes—in papers published in the several districts, and spent, of course, in proportion to the amount subscribed by the undertakings in each district. The balance was spent on publicity, similarly specialized, in magazines, popular weekly papers, the journals of the architectural, educational, medical, and nursing professions, and of the building and other trades, and in research work that formed the basis of some of this publicity. In regard to the publications of national circulation in which the Association advertised, it was worthy of mention that when the Secretary made inquiry in Glasgow, and again in Blackburn, he found between sixty and seventy papers of national circulation on the Association's list were sold on the bookstalls. No one not on the Committee could realize the thorough and scientific way in which the case for gas was persistently presented in the authoritative, as well as the popular, Press throughout the country, and not least in the Press which was special to the professions and trades whose goodwill was vital to the gas industry. Every member doubtless saw occasional evidences of the campaign; but the most voracious reader of papers and periodicals could not possibly see them all. Only those who were in touch with the whole of the details of the work could realize its full extent. For this and other reasons, he would strongly commend to the members the proposal to increase the membership of the Executive. The General Committee had already increased their numbers by inviting all Past and Vice Presidents to attend their meetings in an honorary capacity; and personally he would like to see the number of elected members on the Committee increased considerably, because he was confident from experience that the more representatives of subscribing undertakings there were in close touch with the working of the Association the more enthusiasm would there be in its support. He often wished that every director of every gas board, and every member of every gas committee in the country, could spend a few days in the secretarial and editorial rooms, and thus see the letters from the public—from architects, doctors, teachers, and editors, as well as from householders and business firms—the correspondence with gas managers up and down the country, and particulars in regard to the assistance rendered to them on a multitude of subjects, the details of all the publicity work in hand, and the number of splendid opportunities for publicity that had to be passed by for want of adequate funds. If this could be the case, they would be having subscriptions on the full basis—and the basis increased—from every gas undertaking in the country. They would exclaim: "£17,000 all there is to spend on this far-reaching productive publicity work for the British gas industry, with its annual turnover of £25,000,000! Why, twice the amount would not be half enough." But this wish could not, of course, be fulfilled, though in some lesser, yet growing, measure it would be realized as the Committee expanded, the district conferences met again, and under the stimulus of the district committees achieved even greater success than before, and the annual conferences were resumed. Meanwhile, they would do the very best they could with the means at disposal, if all the members, and the financial powers behind them, endorsed, as the Committee believed they would, the last two paragraphs of the report. In support of the policy of continuity of effort so recommended by the Committee, he might just mention a striking and well-established fact. Whenever an advertiser, with a view to economy, either ceased for a time to advertise or materially reduced his advertising expenditure, he had eventually to spend far more than the amount by which he economized, in addition to his previous full expenditure, in order to make up the ground lost by his reduced advertising. He could give three notable instances of this. One firm reduced its advertising expenditure by 75 per cent. for one year, and for five years afterwards had to spend 50 per cent. more than the original expenditure in order to recover lost business. Another reduced an expenditure of £40,000 a year to £10,000, and had to spend £100,000 in each of the next two years to make good the blunder. The third reduced its annual publicity bill from £75,000 to £35,000 for one year, and had to spend an additional £105,000, spread over three years, over and above the former high level of expenditure, to recover the business lost by "saving" £40,000. It was true that the sale of gas did not present an exact parallel to the commodities here referred to; but in a less marked degree the same result would follow from any slackening in the advertising of the one as did from the same action in the case of the others. There could, indeed, be no doubt that the way to get value out of publicity was to maintain a steady attack upon the attention and interest of the public, and so achieve a cumulative result. In spite of war conditions, all of them could plainly feel at the present time the cumulative effect of the past four years' steady campaign. The current of public favour was flowing with noticeably increasing force towards the gas industry. To withdraw the originating impulse, and let the momentum slow-down and die-away now, would be, in his opinion, the falsest of "false economies." ["Hear, hear."] It might be said that they did not want additional inquiries for gas and gas appliances, as they could not supply any more of either. Well, the motor-car makers in this country could not promise delivery for months, or even years, at the present moment, owing to being occupied on Government work. Yet they continued to advertise, in order to keep themselves in the memory of the public, and so prepare for the day when they would be very glad of orders. If one could not supply a gas-fire to-day, or this winter, it was something gained to have created in a consumer the desire for one, and to have noted his order for action later on. In the gas industry they were not working only for to-day and to-morrow. They wanted to buttress and widen the foundations of the industry for the years to come, to consolidate the property they wished to hand on to future generations, to prepare to-day the way for vast expansion in the future. This was why the Committee asked the members to authorize them, as soon as their income was assured, to proceed with a strong campaign for the development of the daylight load and for the general advancement of gas in popular favour, and why they asked every member to assure them a full, and, if possible, an increased, income for the year that had now commenced. He concluded by moving that the report of the General Committee and the statement of accounts, together with the recommendations for the alteration of the rules therein contained, be approved and adopted.

Alderman F. Templer Depree, J.P. (Chairman of the Council of the Society of British Gas Industries), remarked that, after the very full way in which Mr. Goodenough had moved the resolution, and the references that had been made to the report and accounts, they would no doubt be satisfied if he merely seconded the motion formally. He had, however, been given this opportunity of rising, for the purpose of making one slight allusion to the accounts, which a footnote had prepared them for. Unfortunately, when the accounts were published, for reasons which the proposer had already explained, the amount of subscriptions which the Society of British Gas Industries had contributed to the fund was not made up to anything like the total of the previous year. In fact, the audited account showed a deficit of about £1000. He, however, took an opportunity of explaining that he was quite sure a certain number of subscriptions would be forthcoming which might well go into the accounts of the financial year. He was very pleased to be able to announce to-day that, instead of the amount with which the Society of British Gas Industries were credited in the accounts, the total should be £2016 15s. 6d. He had ventured to point out that there were various reasons for the difference in the amount. It was well known to all those connected with the gas industry—or, indeed, with any other industry—that this terrible war was bound to affect everything. The action of the Government, in withdrawing the loans they had been in the habit of making the gas undertakings for the purpose of increasing their plant, had very much affected certain branches of gas apparatus manufacture—more particularly what were known as the "heavy" branches. They hoped that these times would pass away. Meanwhile, he trusted that those who did intend to subscribe—and he took it that those who had subscribed would continue to do so, as they must have felt the benefit of it—would act on the hint which the proposer of the resolution had thrown out. That was to say that, instead of waiting until the last moment, they would let the Association have the money promptly, so that they could spend it and do good with it, and perhaps avoid placing their Secretary in an invidious position.

Mr. R. W. Edwards (Aldershot) said that, with all due respect to the explanation made by the last speaker, he did think that the difference between the subscriptions of the manufacturers and those of the gas undertakings was too wide. It was a matter which he had on several occasions commented upon. The Society of British Gas Industries should make up their mind to level their contribution up to within reasonable distance of the subscriptions made by gas undertakings. They participated in no small degree in the benefits of the Association; and it did seem to him that the time had now arrived—even if temporarily suspended during the war—when they should make good the deficiency.

Mr. W. E. Price (Hampton Court) said they might congratulate themselves upon the wonderful strides the Association had made in the last few years. He would like to impress upon everyone present the importance of bringing all persuasion that they possibly could to bear upon their Boards of Directors to get in the subscriptions; for in spite of all that had been said, and the encouraging words they had had from the Chairman of the Executive, he thought in some cases it would need all their persuasion, under these special circumstances, to get the amount of contributions which had been forthcoming the last few years. First of all, there was the tightness of money; and, in addition to this, there was—what might probably appeal more to them—the difficulty existing at the present time in carrying out even the orders which were in hand, owing to shortness of material and labour. But obviously the right policy was to continue to press forward, even more than they had done in the past. He was sure those of them who were in at the birth of the Association really marvelled at the size to which it had grown. He did not think any of them really expected that it would grow to the extent to which it had; but even now they should still look forward to the increasing of the Association until, as had already been said, all came in, because it was obvious that for the few who remained out to derive benefit from those who did the paying was unfair. It should only need bringing to the notice of those who practised these methods, to make them see that it was an unreasonable position to take up, and make up their minds to adopt a different attitude, so that the Association could reach the 100 per cent. Subscribers should, he felt, make greater use of the machinery of the Association to get assistance from it. There must be many subjects placed before members of the Association with which perhaps they were not so familiar as might be wished; and they should remember that the Association had the power, and the ability, to supply the desired information, which it would be impossible for one man to do. This method of securing assistance should be very much more used than was the case at the present time. In this connection, special mention might be made of a question that was in the minds of many of them just now—the question of the appliances and material, the various burners, fittings, &c., being used for munitions. This was quite a new branch; and many of them, he was sure, did not feel as able as they would wish to recommend that which was the best for a particular purpose. He was confident that the Association would be able, with the expert ability which it had available, to give assistance and advice, not only to gas undertakings, but also to those manufacturers who were taking on the munition work, and so lead to an increased consumption of gas. Those who looked carefully into what the Association had done would see that very much more could be done; and more use could be made of the Association, if only the members would avail themselves of it.

Alderman F. S. Phillips (Salford) expressed the opinion that, in regard to the report and accounts which were before them, they had every reason for satisfaction, when they looked back upon the short term during which the Association had been in existence, and at the character of the work which it had done. There was, however, one point on which he was not quite satisfied. It was that they had only somewhere about 80 per cent. of the undertakings members of the Association. This was a great achievement in four years; but while he had the opportunity, he wanted to drive home to the members present that it depended somewhat on every one of them individually to do something to alter this figure, and get it nearer the 100 per cent. And to the Executive Committee he would like to emphasize what Mr. Goodenough had said a few moments ago. He instanced certain business firms who, after they had relaxed their advertising efforts, had to expend a very great deal more money to recover their position. Now, some effort had been made during the past year to endeavour to convert the unconverted and bring them into the fold. From the same point of view, these efforts must not be relaxed. ["Hear, hear."] He would like to suggest that the Committee should consider as early as possible further efforts—unremitting efforts, persistent efforts, determined efforts. These people must come in; and if all exerted themselves individually, he was quite sure they could get them in. He knew of one undertaking that had now come in. He had personally tried this undertaking, and had come away with the feeling that it was perfectly hopeless; and now it was in the Association. It was not his effort that had done it, but with this experience before him, he felt quite convinced that, if the members would not give up, the outstanding undertakings would. If the Association was determined to have them in, they could not stand out; and they must have them in. With regard to the alteration of the rules, this was a healthy sign. It meant that there were more people coming in and taking part in the work; and he was glad that it met with general approval. He looked back to the time when they had not the Association, and when they, as members of a gas undertaking, were, so to speak, secluded in their own respective areas, without any opportunity of conferring with others. He did very much rejoice in the opportunity of meeting good friends in the gas industry; it helped so much. And when one got collective wisdom and collective effort, it was a splendid movement.

Mr. Thomas Berridge (Leamington) said he was sorry that Sir Hallewell Rogers and Captain Hilton, representing Birmingham and the Midlands, were not present. The former gentleman, who was to be their new President, was, as they were aware, the Chairman of the Birmingham Small Arms Company, and so was probably better engaged at that moment than he would have been by attending their meeting. Captain Hilton, being connected with the High Explosives Department, was also no doubt better engaged. He (Mr. Berridge) could, however, assure the members, on behalf of the Midland gas undertakings, that they would welcome them very cordially in Birmingham next year. They earnestly hoped that by then the war would be over, and that they would be able to get back to something like previous meetings. He was chiefly concerned with the smaller gas undertakings, with some twelve of which he was connected in the Midlands. Eleven of these were in the Association at present; and he was sure that eventually they would be able to record 100 per cent. Every one that had joined had derived considerable benefit from doing so. There was always some little question arising, in connection with which expert advice was needed; and all they had to do was to write Mr. Mason, and secure most valuable advice. ["Hear, hear."] He rather believed himself that a good deal came from Mr. Goodenough; but, at any rate, they got it, and were grateful for it. From his own experience, he strongly recommended everybody to join the Association.

Mr. John Young (President of the Institution of Gas Engineers) said he was also pleased to support the resolution of the Chairman of the Executive. The amount of the work that had been done during the four years' existence of the Association was very, very difficult indeed to realize. If they would just glance back to the time when they had no publicity campaign, and think of the newspapers they studied and the very few instances in which they ead of gas or saw a decent gas advertisement, and then looked at to-day, when they could not pick up a paper of any kind without finding—either by advertisement, paragraph, or in some other way—gas thrust upon them in the most delightful manner, they would appreciate the change. He himself had been an advertisng man all his business life; but he shrank into insignificance when he reflected on his own feeble efforts as compared with the wonderful work of the Association. He was sure every body f business men would consider it a sound commercial proposiion to maintain, and if possible increase, the subscription to the Association. He did not know whether it was always easy to onvince large bodies of (say) municipal authorities that money pent in this way was a sound business proposition; but certainly the officials of every gas undertaking realized so strongly the reat benefit they received that it would not be their fault if the ubscriptions failed to be not only maintained but increased. He looked forward to seeing the 100 per cent. of undertakings which they all wished to come into the fold.

Mr. Thomas Glover (Norwich) remarked that he could really nly say "ditto" to previous speakers—especially Mr. Berridge nd Mr. Young. He had been asked to support or criticize the eport. It seemed to him, however, that the atmosphere was en-rely favourable to the Association; and a critic might not find imself very comfortable.

Mr. Goodenough: If you have any criticism to make, Mr. Glover, let us have it.

Mr. Glover: Well, I have not. Continuing, he said it would e a very mild one, if there were any. He recently saw a para-raph in a paper which was giving some advice to parsons, in which it was remarked that if parsons would only say less about the easons why people should go to church, and preach the gospel, erhaps people would go more frequently. It appeared to him hat if there was any weakness about the Association, it was that said a great deal about itself; and it was perhaps only natural o a new and vigorous Association that it should concern itself ith itself a good deal. But the advice given to the parsons could e applied to a small extent perhaps to the Association. Let them make the Association so good that reluctant people would come n more readily. He did not know how it was to be done; and robably those at the head of affairs were doing it as hard as they ould. All the members appreciated very much the work that had een done, and particularly the ready response they got to any nquiries sent to headquarters. He thoroughly agreed with what Mr. Berridge had said in this connection—that any inquiries sent o Mr. Mason elicited very good answers and very good advice.

The President said if there were no more speakers, he would call upon Mr. Goodenough to reply to the points that had been raised.

Mr. Goodenough remarked that he had really very little to reply to. Alderman Phillips commended to the Executive greater activity in pushing the claims of the Association upon non-subscribers; and Mr. Glover told them not to advertise themselves so much, but to get on with the work. He was afraid these two arguments were mutually destructive. When they had 100 per cent. of support, they would be very glad to give up talking about themselves and get on with their job. It was because the Committee felt that a good deal of energy had sometimes to be diverted from the original objects of the Association to the conversion of the unconverted, that they would, more than anyone else, welcome the advent of the non-subscribers to membership. He thought if Mr. Glover carried his argument to the final point, he would be arguing against advertising gas at all; but he would not be likely to carry it to this extreme.

A Letter from Sir Hallewell Rogers.

Mr. Goodenough (continuing) said Mr. Berridge had referred to the absence of Sir Hallewell Rogers; and he would therefore take the opportunity of reading a letter he received from him, after having formally invited him to stand as candidate for the presidency of the Association. The letter was as follows:

> *Sept.* 30, 1915.
>
> Dear Mr. Goodenough,—I thank you for your letter of the 29th inst., and appreciate the invitation extended to me by the General Committee.
>
> I shall be very glad to accept nomination, but regret that it will be impossible for me to attend the meeting on the 19th of October, as on that day I have to bring before the Council an important Gas Committee report. Every Tuesday, also, I am engaged from 12 till 2 o'clock by a Bank Board.
>
> I shall be glad if you will express my appreciation of the honour at the meeting. I shall, however, quite understand if the members decide to nominate someone who has more practical experience in the work of the gas industry.—Yours faithfully,
>
> Hallewell Rogers,
> Chairman of the Birmingham Corporation
> Gas Committee.

The President then put the motion for the adoption of the report and accounts; and it was unanimously carried.

Alderman W. Armitage (Doncaster) remarked that a duty now devolved upon him which was very slight and very formal. Often in his public life he had plunged into matters which were not formal, and had rather enjoyed the fight. On this occasion, he had a pleasant duty—namely, to move the following resolution: "That, in view of the continuance of the war, the retirement from office of those members of the Executive and General Committees who would otherwise have retired in October, 1915, be postponed until the annual general meeting in 1916." This meant that things were to remain as they were. At election times, when he had to fight for his seat in a certain ward, a resolution of this kind would have suited him admirably. He did not think they could better the men referred to in his motion. No doubt, when the "war drums throbbed no longer, and the battle flags were furled," they would revert to the former condition of things. He felt sure the resolution would meet with the approval of the members, and would be carried unanimously. This was not a time to fritter away possible energy which should be diverted to another direction. When, however, the happy time arrived that the war was at an end, he hoped that the flags would be unfurled, and that there would be such doings as had never been known before in the gas industry. [Applause.]

Mr. J. William Glover formally seconded the proposition, which was unanimously agreed to.

The President and Auditors.

The report of the Scrutineers was then received; this being to the effect that Sir Hallewell Rogers was elected President, and Messrs. Cash, Stone, and Co. were re-elected Auditors.

Votes of Thanks.

Alderman William Kay (Manchester), proposing a vote of thanks to the President, said his services to the Association during the last two years had been unique in every way. For one thing, being the first elected President rather marked him down as a stepping-stone to a very great future for the Association. In Bailie Paxton, they had a President worthy of the huge undertakings which the Association fostered in every possible way. Really, when speaking of the President, he did not know whether he could say anything which they were not all aware of. His geniality, his ability, and his sound commonsense, and the admirable way in which the meetings he had presided over had been conducted, were all well known; and if he (Alderman Kay) spoke till Doomsday, he could not say more to commend him to the members.

Mr. Cyril G. Davis (London), in seconding, remarked that it was hardly necessary for him to add anything to what Alderman Kay had said. They were certainly fortunate in having, at this very dreadful period of their lives, a man as President with such strength of character and such a broad mind as Bailie Paxton.

The motion having been put to the meeting and carried with applause,

The President said he was proud of having received such a warm vote of thanks. The Association had been very good to him. It had extended great sympathy and help to him in his little efforts on its behalf. They were good enough to send him on one occasion with Mr. Mason to Munich. They had a splendid time there, and were lucky enough to get back before war was declared. He sincerely thanked them all for their great kindness to him during the past two years. It was his hope and belief that the work of the Association would go on prospering, under the able guidance of the Executive now in charge of it.

Mr. Fred Tilley (London) proposed a vote of thanks to the Committees and officers who, he said, had been working so hard for the Association during the past year. It was surprising to receive so many communications from them, giving all kinds of useful information. The "Bulletin" itself must take up a considerable amount of time. Although no doubt it was a pleasant task, the ordinary business man in these days had not always time to tackle such an undertaking as this must be. It showed that the Executive Committee were causing a very great amount of work to be done which benefited the gas industry as a whole.

Mr. George Stevenson (Long Eaton), in seconding, said the President in his address had already paid very generous tribute to the work done; and he was quite sure that all the members cordially agreed with every word that had been said. His own opinion was that no Association could possibly be better served, or at less cost; and though this vote of thanks might seem rather formal, he believed it was the wish of every member that the Committees and officers should take it as a very sincere and very cordial one.

The proposition having been heartily endorsed by all the members,

Mr. Goodenough, replying on behalf of the Committees, remarked that, as he had said in moving the adoption of the report and accounts, the Committees got their full reward for all the time and trouble they might give to, or the work they might do for, the Association, in the splendid and increasing support which the Association received throughout the country. Beyond this reward, they asked for nothing. But it was a very great pleasure indeed to feel that they had the good-fellowship and good-will of the members, as well as the practical support which was so vital to the success of their work. He would like to pay tribute to the excellent work done by all the officers of the Association—Mr. Mason and his assistant, their Editor, and their Advertising Agent. They, together with himself, formed a sort of inner cabinet who had to deal with working details from day to day; and he could say that in this inner cabinet, while there was plenty of discussion and disagreement on details, they always arrived at a harmonious conclusion. He got assistance from every member which was invaluable to him, which he greatly appreciated, and from which the Association derived great value.

Mr. Mason, for the officers, said the feeling in his heart that day was that they had a tremendous lot to be thankful for. It was always good to have work well done behind one; and the Committees and officers certainly had this. He would like to point out that the accounts did not show on the surface the biggest asset the British Commercial Gas Association possessed. This asset was the Chairman of the Executive, Mr. Goodenough; and he (Mr. Mason) could say most sincerely that it was a very real inspiration to have the privilege of working beside such a man. [Applause.]

The President said there was one other proposition. They had that day held three meetings there; and it was very good of the Council of the Society of Arts to give them the use free of their beautiful hall. He proposed a hearty vote of thanks to them for their kindness.

Mr. Goodenough seconded this, and it was heartily agreed to.

This concluded the business; and the members separated after taking tea together.

THE AMERICAN GAS INSTITUTE MEETING.

[From Our Own Correspondent.]

When the Institute, three years ago, accepted the invitation of the Pacific Coast Gas Association to act as the sponsor for an International Gas Congress, it was clearly understood that the location of San Francisco would prevent the attendance of many Institute members, who would not be able to make the journey of over 3000 miles, and that, because of the sessions of the Congress, the meeting of the Institute must be limited to a brief business session. Therefore the meeting called to order on the afternoon of Tuesday, Sept. 28, by President E. C. Jones, had no papers to consider, and received most of its Committee reports by title. In the circumstances, the number in attendance (about 100) was considered quite satisfactory.

Report of the Directors.

The first item was the Directors' report. This announced the election to life membership, without the payment of any fee, of Mr. Frederic Egner, "as a fitting reward to a life of effort for the benefit of the gas industry;" it touched on the diversified energies of the Technical Committee working through its various Sub-Committees, and the value of the Public Relations Committee acting as a skilled adviser in the interests alike of consumers and sellers of gas, in the settlement of the many questions which arise between the latter and the public service commissions; and it recommended certain changes in the constitution affecting affiliation with State Associations and the organization of the Institute sections.

Membership and Finance.

The Secretary reported the election during the year of 69 members. The financial statement disclosed that a deficit of almost $5000, due to the increased expenses caused by the 1914 meeting, had now been covered by special subscriptions from various gas companies.

The President's Address.

Mr. Jones then delivered his Presidential Address. He began by calling attention to the fact that no National Gas Association had hitherto held a meeting west of Denver. This was not strange when it was realized that with London as a centre, a circle whose radius was the 3300 miles distance between New York and San Francisco would include Newfoundland, Greenland, Europe, and about one-fifth of Africa; so that a Congress in London would be as near to the dwellers in the above-described area as San Francisco is to most of the Institute members.

He spoke of the Collective Gas Exhibit, the facts concerning which have already appeared in print; but it may be stated here that it is lighted by gas, occupies 10,000 square feet of space, is a "convincing exponent of the economy and efficiency of gas illumination," and was awarded a Grand Prize. He urged a study of the work of the various Committees and its continuation, to the end that "the Institute may become a clearing house for the settlement of questions of policy relating to all departments of the gas business."

He referred to forty years of unfaltering devotion to the gas business, "during which no fear of the future glory of the gas business, nor loss of faith in its eventual predominance, has ever crept in." "The success of our business depends on the individuals engaged in the various departments, and grave responsibility rests upon the men who are the framers of its destiny. An unshaken belief in the efficiency and economy of gas for all purposes is necessary to a permanent development of the business, and the agents must be gas men, not gas-and-electric men."

The appointment of a Committee on the President's Address was deferred, owing to the lack of time for the performance of its duties. Its report will be printed in the "Proceedings."

Office-Bearers.

The Nominating Committee presented the following names, which were unanimously elected:

President.—W. E. M'Kay, Boston, Mass.
Vice-Presidents.—Manufacturing Section. — Herman Russell, Rochester, N.Y. Chemical Section.—Dr. A. H. Elliott, New York City. Distribution Section.—J. D. von Maur, St. Louis, Mo. Illumination Section, C. O. Bond, Philadelphia, Pa. Accounting Section.—J. P. Crowley, St. Paul, Minn.
Directors.—D. D. Barnum, Worcester, Mass.; R. B. Brown, Milwaukee, Wis.; C. M. Cohn, Baltimore, Md.; G. B. Cortelyou, New York City; R. B. Harper, Chicago, Ill.; and R. W. Bush, Brooklyn, N.Y.

This is the first year that Sectional Vice-Presidents have been elected, and each is expected to assist the Technical Committee in directing the work of the Institute on subjects belonging to his section. This organization should go far in making the 1916 meeting and the work of the coming year even more successful than the 1914 meeting, and the effort it marked.

Committee Reports.

Though the Committee reports were with few exceptions read by title only, their contents will be briefly given here, as they may not be in print for some time, and the meeting report would be incomplete without at least a summary of what the Institute has been doing this past year.

The Public Relations Committee described their activities during the year with gas companies and public service commissions, and the formation of a Sub-Committee on Installation Regulation and Safety Code to co-operate upon these questions with the Bureau of Standards and the National Fire Protection Association and other fire insurance bodies.

The Technical Committee summarized the work of the various Sub-Committees, reported changes in the routine of their appointment (by which committees whose work was not completed at the end of the Institute year would be continued, subject to any change that might be desired by the incoming Technical Committee), recommended enlisting the technical assistance of the affiliated Associations, and giving wide publicity in the "Institute News" from month to month of the work being done.

Considering, now, the Sub-Committees working under the Technical Committee, there were the following reports.

The Committee on Accident Prevention gave an analysis of 6000 accident cases, under causes and effect of accidents. Last year 3500 cases were analyzed. A revised plan for a company's safety organization was submitted, together with new safety rules and precautions. A motion picture film, showing the safe and unsafe ways of doing daily tasks in the industry, accompanied the report. The film gave views of present and past officers of the Institute. It is expected that the film will be loaned for use by gas companies throughout the country, and will be of great service in inculcating safety ideas.

The Bureau of Information submitted data as to questions received and answers given during the year, and also stated that there was reason to believe that at present there was no real need for the Question Box, for without artificial stimulation, questions were not being received. It was thought that if the work was to be carried on it should be done by a paid employee, rather than by a voluntary Committee as in the past.

The Committee on Carbonization this year decided to make a study of coke, and in so doing described the formation of coal and its mining and preparation for market, presented the results of numerous investigations upon the effect of storage on coal, and from these investigations made certain recommendations. A general outline of the coke requirements for metallurgical and domestic use was given, together with a description of the usual methods employed to produce a metallurgical coke. The report concluded with some remarks upon the formation of coke, and described several series of experiments showing the effect of various methods of carbonizing upon the character of the coke produced.

The Committee on Chemical Tests has enlarged the tentative "Gas Chemists' Handbook" submitted by Mr. Fulweiler last year, and it now embodies the best information obtainable in the present state of the art; so that it may be "safely used not only as a laboratory manual," but also for the purchase of raw material used in the gas business. It will be published early in 1916.

The Committee on Classification of Gas Engineering reported that at the beginning of their work they found a great demand in other lines of engineering for a suitable classification. The movement had now grown into one embracing 44 societies and institutions, and there is good reason to hope that in the end a classification could be adopted which would care for all branches of engineering, would serve as a basis for filing clippings, for cards in a card index, and for printed indexes, and that the publishers of technical periodicals might be induced to print against each important article the symbol of the appropriate class in this system, so that, by clipping these articles, a file might be easily made which would combine in one system these clippings, together with all other material to be classified by the same system.

The Committee on Gas House Piping presented a report containing suggested specifications governing the installation and testing of house piping and the installation of house services. The report included two tables—one for water gas and the other for coal gas—each embracing pipe from ⅜-inch to 4 inches in size and from 1 to 1000 openings, and giving the number of feet of pipe allowable for 0·1 inch in pressure. The report was regarded as one of progress; and its recommendations will be before the Institute at least a year before any action is taken on them.

The Committee on Gas Lighting reported that, as preliminary to prescribing standard conditions for testing gas-lamps so as to determine their rating, tests of three representative lamps—three-burner inverted arc lamp equipped with clear globe, single-burner nverted lamp equipped with clear air-hole cylinder, and single-burner upright lamp equipped with clear air-hole chimney—are now under way in four laboratories, one of these being that of the Bureau of Standards. Also, that at one laboratory tests of the same kind had been carried on by testing standard equipped lamps on local gases of different composition. The Committee also hoped to start three other lines of work, as given below:

1.—Reach an agreement, if possible, as to the proper place or places for such tests, and begin the collection of actual data on the efficiency performance, distribution curves, &c., of lamps to be rated in accordance with the standard conditions for testing gas-lamps.

2.—A study of the methods of ignition, including distance ignition, looking to the approval of those which are safe, certain, and convenient.

3.—Determine the characteristics of the ideal gas suited to give high efficiency and good service with present lamps on the market.

As part of its report, the Committee submitted a tentative, but very complete, glossary of words, terms, and phrases used in the subject of gas lighting, compiled by Mr. R. B. Harper.

The Committee on Gas-Works Auxiliaries limited its work this year to the "instruments which the gas engineer may use in keeping himself informed of the conditions of plant operations." The report is divided as follows:

Part 1.—The development of an averaging Pitot tube device for measuring the flow of gases in pipes.

Part 2.—Various types of pressure gauges, manometers, and U tubes; their use and proper application in gas-works.

Part 3.—Various types of pyrometers, basic principles of their operation, and proper application in gas-works.

The Committee on Meter Connections submitted drawings of various methods in use for setting meters and of meter-cocks with specifications for their composition, and asked for suggestions for the use of the Committee next year. The whole idea of the report is to attract attention to the subject of meter connections, with the hope that, as a result, some decision can be reached as to the standard methods for each type of connection used in this country.

The Committee on Physical Tests have done some work, and expect to submit a report for the "Proceedings," but had none ready for the meeting.

The Committee on Cast-Iron Pipe Joints presented a preliminary report in which the theory of the bell-and-spigot joint was discussed. Current practice in joint-making was shown by a table summarizing the conclusions from 58 answers received in reply to a circular sent to 70 large companies. These replies indicated that cement joints were being used for small mains in two-thirds of the cases, and were entirely satisfactory; also that lead wool was being used in large main joints by one-sixth of the companies, and was entirely satisfactory. A proposed specification for cement joints was given, which represents departures from standard practice in certain respects, and which will undoubtedly be criticized by the members of the Institute before its adoption. The report concludes with a short description of some tension and compression tests on various forms of large main joints. These would so far indicate that a joint made by putting into a bell 4½ inches deep, about ¾ inch of yarn, and inserting cement until there is only just room enough for 1¼ inches of lead wool, will stand more reversals of pressure under higher stress than any other form of joint—the small lead wool being, however, almost as good. Some of the experiments also indicate that the amount of compression of the yarn has much to do with the ability of the joint to remain tight under stress and motion.

The Committee on Pipe Standards, whose principal duty it is to promote the use of the standards already adopted, reported the addition of a few special castings.

The Committee on Refractory Materials has held several meetings during the year, and has made good progress; being greatly aided by the manufacturers and the Bureau of Standards. Its report, however, was not ready for the meeting.

The representatives of the Joint National Committee on Electrolysis stated that the report of the Committee would probably be complete within a year.

The Committee on Supplying Large Buildings with Gas presented as its report a table of contents of a proposed book intended as a data and reference book for architects and builders. It is the intention of the Committee to complete the work during the coming year. The suggested table of contents is as follows:

I.—Introduction.

II.—Gas service: (*a*) Continuity and character of service. (*b*) Reliability of supply. (*c*) Quality of supply. (*d*) Quantity of supply.

III.—Why buildings should be piped for gas: (*a*) 1 Modern building principles. 2 Changes in character of occupancy. (*b*) Financial aspect. (*c*) Tenants who use gas.

IV.—Uses of gas: (*a*) In the home. (*b*) In the industries. 1 Advantages. 2 Lighting appliances. 3 Fuel appliances. 4 Power appliances.

V.—Gas as an illuminant: (*a*) 1 Advantages. 2 Artistic considerations. (*b*) Flexibility. 1 Sizes of units. 2 Consumption of units. 3 Candle power of units. (*c*) Control. 1 Systems of control. 2 Pilot light consumption. (*d*) Hygienic value. 1 Quality of light. 2 Effect upon the eyes. 3 Aid to ventilation. 4 Safety. 5 Effect of gas light upon the atmosphere. (*a*) Oxygen reduction. (*b*) Heat generation. (*c*) Carbon dioxide generation. (*d*) Effect on humidity. (*e*) Air movement. (*f*) Reduction of bacteria.

VI.—Gas as a fuel: (*a*) Provision for future demands. (*b*) Advantages. 1 Reliability. 2 Safety. 3 Economy. 4 Convenience. 5 Cleanliness. 6 Ease of control. 7 Space economy. 8 Labour economy. 9 Operating economy. 10 Applicability. 11 Table of fuel appliances.

VII.—Gas as a source of power: (*a*) Advantages and scope of field. (*b*) Considerations governing choice of power unit. (*c*) Horse power required for various classes of service. (*d*) Cost comparison—gas *v.* electricity.

VIII.—Gas piping: (*a*) Piping at time of erection. (*b*) Cost of piping at time of erection. (*c*) Cost of piping after erection. (*d*) Piping layouts. (*e*) Standard piping specifications.

The Committee on the Utilization of Fuel Appliances, in a brief report, again calls attention to the desirablity of using ranges built according to the standard specifications. It speaks of the gradual development of the "fireless cooking," or heavily insulated, range, which is slowly finding a place for itself. For small kitchens, it advocates a range with both a baking and a broiling burner in the same oven, if proper means are taken to prevent their simultaneous operation. It speaks of the rapid increase in the use of water-heaters, both with and without thermostatic control. It states that the latter gives satisfactory service, except when uniform temperature of the water is required. It states that some gas companies will experiment this Fall with auxiliary gas-fired heaters attached to central heating systems, in the hope that the convenience of gas heat under these conditions will open its way to such use in many houses. It announces that the efficiency tests of gas room-heaters will soon be completed and published as an appendix to the report. It exhibits, for the purpose of inviting discussion, a design for slip-end hose cocks.

PLACE OF NEXT MEETING.

After these technical reports had been disposed of, the Committee on Next Place of Meeting asked permission to refer such choice to the incoming Board of Directors; remarking, however, that Chicago had been under consideration.

THE BEAL MEDAL.

The Committee on the Beal Medal, for the best paper contributed to the 1914 meeting, announced their award to Mr. F. W. Steere, for "An Electrical Process for Detarring Gas."

The Presidency.

The Institute then recessed under a motion by which final adjournment occurred on Friday midnight. This had the effect of allowing Mr. Jones, whose term of office expired with the meeting, to remain President during the sessions of the Gas Congress, and the accompanying entertainments. At this juncture it is eminently fitting to record the energy, enthusiasm, and hospitality of this ever-young standard bearer of the interests of gas, whose every look and act belies the years of his known achievements. Every traveller from afar will take back home renewed courage and pleasant memories derived from his contact with this Nestor of the West.

Next Year's Candidates.

After the Institute meeting, the various sections met to choose candidates from which next year's Nominating Committee will choose one Vice-President from each section. The names are: Manufacturing, G. B. Evans, J. H. Eustace, W. C. Morris. Chemical, J. M. Morehead, C. C. Tutwiler, E. C. Uhlig. Distribution, J. W. Batten, C. C. Simpson, jun., G. I. Vincent. Illumination, Norman Macbeth, J. A. Norcross, E. C. Jones. Accounting, F. R. Barnitz, William M'Clellan, H. W. Peck.

The Social Events.

As the Institute meeting was entirely subordinate to that of the Gas Congress, the entertainment features of the latter took the place of the usual social side of Institute meetings, and will be described when relating the events of the Congress.

GLOVER-WEST VERTICALS AT OTTAWA.

The Ottawa Gas Company is relatively not a very large concern; gas lighting being almost *nil* and the bulk of the gas being used for cooking—a service not yet developed to anywhere near its possibilities. Nevertheless, the Company found themselves requiring new gas-works; and, with Messrs. Merrifield and Burnett, of Toronto, as Consulting Engineers, they have had a plant designed and laid out on paper for an ultimate capacity of 6 million cubic feet per day, divided into four self-contained units of 1½ million cubic feet, only one of the units to be built in the first instance. After a study of the various systems of carbonization, the Glover-West continuous vertical retorts were selected for the first unit; and in regard to them, Mr. A. A. Dion, the General Superintendent of the Company, read a paper at the recent eighth annual meeting of the Canadian Gas Association.

Description of the Installation.

After his preliminary observations, Mr. Dion said: The carbonizing plant consists of a stack of six settings of Glover-West vertical retorts, eight retorts to each setting, 48 retorts in all. The contractors' rated capacity of each setting is 300,000 cubic feet per diem, or 1,800,000 cubic feet for the six settings. We rate the plant as being capable of making 1,500,000 cubic feet per diem under ordinary conditions of working, day in and day out; and experience indicates that, allowing for proper scurfing periods and without forcing the benches, each setting will make considerably over 250,000 cubic feet, at which we rate its capacity. Complete provision has been made for the mechanical handling of coal and coke. The coal-cars coming in over our siding are shunted within our grounds as required, by means of a small electric locomotive getting current from an overhead trolley system. The coal may be dumped into an underground hopper, whence a grab-bucket, electrically operated, on a telpher system, takes it to storage or directly to the crusher, or the cars may be unloaded from overhead also by grab-bucket.

The coke is conveyed to a coke-pocket, under which carts may drive, or it may be carried by grab-bucket and loaded upon cars. When the coke-pocket is full, coke may be carried along a steel trestle and piled on the ground, or it may be stored in a part of the coal-storage building.

The coal telpher system and coke telpher system are interchangeable, so that one can replace the other in case of stoppage for repairs, &c. The use of the vertical retorts, coupled with this mechanical handling of coal and coke, has resulted in considerable reduction in labour over less modern arrangements.

The other parts of the plant possess no unusual features and seem to conform to recognized good practice.

The vertical plant was started on March 29 last, and gas was turned on to the mains on April 1. It has been in continuous operation since that date, with a varying number of retorts in action, according to the fluctuations in the output of gas. At no time since commencing operations has there been the least interruption in the manufacture of gas, and the whole installation works smoothly, with adequate attention. It is a pleasure to be able to say that, from all view-points, this installation of verticals has been a success so far, and that the expectations of the owners and managers have been fully realized in practice. The gas produced has been of uniform quality, the yield large, and the heating value well up to the requirements of the Government. The public has not been slow to recognize the improvement, especially as the distribution of gas from the new works has resulted in a more uniform pressure throughout the city and throughout the hours and days.

Results of Working with Pittsburgh Coal.

The following data were taken from the Company's records for the months of June and July. The coal carbonized during this period was from the mines of the Pittsburgh Coal Company (thin vein Youghiogheny coal, three-quarter lump), and an analysis lately made of an average sample gave this result:

Volatile matter	31·400	per cent.
Fixed carbon	63·395	"
Moisture (after drying).	0·205	"
Ash	5·000	"
Sulphur.	0·828	"
Volatile sulphur	0·276	"

Gross calorific value per pound, 17,700 B.Th.U.

The quantity of coal carbonized during the two months was 3212·75 tons (of 2000 lbs.), and the total quantity of gas made, corrected to 60° Fahr. and 30 inches barometer, was 42,835,811 cubic feet. This is an average of 702,226 cubic feet per day, and 13,336 cubic feet per ton of coal, or 6·668 cubic feet per pound. The calorific value of the gas averaged 542 B.Th.U. during June, and 531·74 B.Th.U. during July. The minimum was: June, 511 B.Th.U.; July, 521·5 B.Th.U. The maximum: June, 573 B.Th.U.; July, 561·1 B.Th.U. These figures are confirmed by Government tests. The tests were made on a Simmance-Abady total-heat calorimeter of the type adopted by the Canadian Government for use at their testing-stations throughout the Dominion.

The yield of gas per ton of coal was found to be quite satisfactory, and rather better than expected. As a very small quantity of steam is at all times admitted to the lower portion of each retort for the purpose of assisting in the cooling of the hot coke before it reaches the extracting chamber, a percentage of the gas yield should be credited to the water gas formed by the decomposition of the steam while passing through the hot coke in the retorts.

The yield of coke per ton of coal carbonized during the period was 1343 lbs. The quantity of coke used in the producer furnaces averaged 17·68 lbs. per 100 lbs. of coal carbonized during June, and 16·36 lbs. in July. The quantity of coke used in the producer furnaces is rather high for the type of benches installed. But this is accounted for by the fact that the benches are not being worked to their full capacity at any time, and also owing to the local conditions of output—this varying considerably from week to week, and necessitating frequent slacking-off in production, which, of course, results in idle retorts, and therefore in increased fuel consumption relatively to the coal carbonized. When running to capacity, the producer fuel is calculated as 13·07 lbs. per 100 lbs. of coal carbonized.

The ammonia plant was not put into operation until lately, and some defects still remain to be corrected; so that the yield of ammonia has been low, and it would be useless to give the figures, since they would not represent normal operation.

Labour Required.

After some coaching on the part of the representatives of the West Company, who erected the retorts, no difficulty whatever was found in adapting the old operators to the work. It was not found necessary to bring in any other experts to help the Company out. One man is employed at the top charging the retorts, and pricking the coal when required. One man at the bottom looks after the producer furnaces and the discharging of the coke. There are three shifts of eight hours, or six men for the twenty-four hours. Two men are employed scurfing—only one shift of ten hours; two men on the mechanical conveyors with one helper—one shift only. Over all these men is the retort-house foreman.

Taking records from the start—namely, April, May, June, July, and August—the average gas made per retort and producer man per day (six men) was 120,148 cubic feet.

The Late Mr. De Brouwer.

"Het Gas" of the 1st inst. gave some further particulars of the life work of Mr. Joseph de Brouwer, whose death on the 27th of July last has already been reported in the "Journal." He was born on Nov. 2, 1843, and in 1865 graduated as Doctor of Law at Louvain, with a view to following the career of counsel. His father, M. Jean de Brouwer, who had interested himself in the erection and exploitation of gas-works, died suddenly, and the son found himself left with the control of four works, including those at Bois-le-Duc, at a time when gas engineering had not reached a high stage of development. He turned his great abilities earnestly towards the new career which was thus thrust upon him, and took special interest in all technical advances. He followed closely the patent section of technical literature; and his own inventions of the De Brouwer coke-conveying trough and the charging and discharging machine achieved world-wide recognition of his inventive talent. He interested himself greatly in inter-communal gas supply—especially in the district of Flanders between Nieuport and Gheel. He was the recipient of distinctions from the Belgian, Dutch, and French Gas Associations, and received a cross of honour of the first class from King Leopold the Second.

ONDON AND SOUTHERN JUNIOR ASSOCIATION.

Opening Meeting of the Session.

At the Westminster Technical Institute, Vincent Square, S.W., Friday, the London and Southern District Junior Gas Assoation held their opening meeting for the present session—the air during the early part of the proceedings being occupied Mr. J. Hewett, of the South Metropolitan Gas Company, the tiring President. In view of the fact that so many of the memrs are still away on active service, and other circumstances, ere was a satisfactory muster of members to hear the address Mr. S. B. Chandler, of the Sales Department of the South burban Gas Company, the new President of the Association.

The Presidential Address.

Mr. Hewett, in calling upon Mr. Chandler to read his address which will be found on pp. 198-200], said he hoped the members ould one and all extend to that gentleman the hearty support ey had given him during his period of office. He remarked at the subject of distribution interested the members, if not ore than, at any rate as much as, the manufacturing side. It as, however, the business of all of them, whether they were tached to this particular department or another, to know as uch as they possibly could about their industry as a whole. here were no doubt many points in the address which would elp them.

Mr. F. J. Pearce, proposing a hearty vote of thanks to the resident, said the subject he had taken for his address had been ealt with clearly and concisely.

Mr. W. E. Brown, in seconding the vote [which was cordially assed], remarked that the address contained a lot of information. mong many points touched upon by the President was the part layed by the gas industry in the present crisis. Very few people utside the industry, he thought, really appreciated what gas and as making meant to the country just now. There was not only he manufacture of high explosives, and that sort of thing, but he fact that the gas industry represented the economical use f the coal supplies. This was a point of national importance hich had just now come very much to the front. Another triking matter to note was the way in which the age of science as supplanting what might be called rule-of-thumb methods. This applied right through, not only in their works, but also in onnection with the manufacture of apparatus. The question of he rates for electric current was, of course, a curious one. The nethods of charging were really very wonderful. It was a puzzle ow their competitors could have devised them all, and a still reater puzzle how they could settle their arguments and disutes with customers afterwards. A point in the address which vould appeal to them all very strongly was the one about the nental disposition of the chiefs of departments, and the qualities equired. There was no doubt a man who was going to successully run a big department, must be able to take every person and very thing as it came along, quite on an independent basis.

The President returned thanks, and assured the members that he reception of his address had amply repaid him for such time and trouble as he might have expended on its preparation. His est endeavours would be given towards furthering the interests of the Association, which he regarded as a very serious proposiion. It was a stepping-stone to higher things, and though junior n title, it was by no means junior in other respects.

Forthcoming Meetings, &c.

The President, alluding to the programme, pointed out that during November there would be two business meetings of great nterest; and he hoped that members and friends would attend n large numbers. On Nov. 12 Mr. Hartley, of the Richmond Gas Stove and Meter Company, would give them a paper, illustrated by lantern slides, on the "Development of Gas-Fires, 1913-15;" and a fortnight later Mr. D. W. Brooks, of the Gas Light and Coke Company, was to deal with "Gas-Furnaces." These were both exceedingly important subjects. Altogether the session promised to be a very interesting one. They would notice that the programme contained a "Roll of Honour" of members of the Association serving with His Majesty's forces. This contained 26 names; and there were two more to be added—Mr. C. R. Peel, of the Gas Light and Coke Company, who had joined the navy, and Mr. A. Broadbent, of the same Company, who was in the Royal Engineers. He wished them a speedy and happy return. He added that in view of the existing exceptional circumstances, and in deference to the wishes of the London County Council, it had been determined that for the present the meetings should begin and terminate at an earlier hour than had hitherto been the custom.

A Couple of Presentations.

The President said he had now a very pleasant duty to fulfil—namely, to convey in some tangible form to the late President and Hon. Secretary the appreciation of the members of the valuable work they had done. The presentations he was about to make consisted of framed illuminated addresses, recording resolutions passed at the last annual general meeting of the Association. In the case of Mr. Hewett, he was quite sure this recognition was thoroughly well deserved. He was a good all-round man, and had upheld the Association in an admirable manner during a time of extraordinary pressure and upheaval of the country. He hoped that Mr. Hewett would long derive satisfaction from the testimonial which he now had the pleasure to hand to him, and which was in the following terms.

> London and Southern District Junior Gas Association.
>
> This Annual General Meeting of the London and Southern District Junior Gas Association desires to acknowledge and place on record its appreciation of the services rendered by Mr. J. Hewett, in conducting the affairs of the Association as President during the session 1914-15. The energy and enthusiasm he displayed at all times have materially enhanced the usefulness of the Association, especially in view of the serious difficulties created by the war in which our country is engaged; and the members hereby tender him their sincere and hearty thanks.
>
> Saml. B. Chandler, President.
> George Winslow, Hon. Secretary.

Mr. Hewett, acknowledging the gift, said he accepted it as a token of the members' appreciation of his efforts. When he was elected President, he realized that it was not altogether easy to fill the position in connection with an Association of this character, which was recognized throughout the country as being by no means junior in importance.

The President said he had now to hand the other address to the late Hon. Secretary. The members all recognized that this was a position to which there was a good deal of hard work attached; and although they very much regretted to lose Mr. Griggs's services, they quite understood that, owing to other duties, he was unable to give that time to the affairs of the Association which he considered was required. The testimonial was in the following words.

> London and Southern District Junior Gas Association.
>
> This Annual General Meeting of the London and Southern District Junior Gas Association desires to acknowledge and place on record its appreciation of the services of Mr. Arthur R. Griggs as Hon. Secretary during the session 1914-15, tendering him sincere thanks for the energy displayed and for the time given in the interests of the Association.
>
> Saml. B. Chandler, President.
> George Winslow, Hon. Secretary.

Mr. Griggs, in returning thanks, said the address came as a very pleasant surprise, and he much appreciated the gift. The President had explained the reasons why he had felt it necessary to resign the secretaryship; and he could only add to this that he regretted very much to have to do so. He could not have had a better President and Council to work under.

This concluded the business proceedings; and light refreshments and a discussion of things in general followed.

PORTLAND CEMENT.

When free lime is present in cement—a fact which cannot be demonstrated by chemical means—its presence is only indicated by a lack of cohesion and strength in the cement some weeks or months after it has been hydrated. Consequently, various tests have been devised to accelerate the action of any expansive constituent, so as to produce evidence of unsoundness in a few hours or days. The test for this purpose most generally accepted is to submit a test briquette to the action of high-pressure steam. The latest information on this point is contained in Technologic Paper No. 47 just issued from the Washington Bureau of Standards.

For the purposes of the test pats of neat cement were made up as usual and stored for twenty-four hours in a damp closet, and then subjected to a steam pressure of 300 lbs. per square inch for at least one hour—the total time in the high-pressure boiler being three hours. A cement is said to pass this test when it exhibits no cracking, warping, or disintegration on examination after the treatment. From experiments on a large number of cements, it is concluded that such a test may be of value in forecasting the behaviour of neat cement or a very rich mortar when exposed under normal conditions in dry air; but it will not forecast the behaviour of cements in concrete as normally exposed.

For practical work under normal conditions of construction, the results of the investigation fail to show that the high-pressure steam test is of any value as a means of determining the ultimate soundness of concrete.

Benzol Supply in Germany.—According to the "Scientific American," in order to prevent the accumulation of benzol, or the manipulation of this product by the manufacturer so as to boost the price, the German Government has forbidden the manufacture of benzol to all persons in the Empire, with the following exceptions: Chemical factories engaged in the making of explosives or chemicals for the Government, and chemical factories which agree to turn over to the Government the entire amount of toluol produced during the manufacture of benzol. To make this latter order effective, every gallon of benzol offered to the German public for motor car use must be freed from toluol. The maximum amount of toluol permissible in benzol has been fixed at 1 per cent.; the Government realizing that in the course of forced production small quantities are liable to become mixed with the benzol.

THE CURRENT POSITION OF GAS TRADING.

By Samuel B. Chandler, of the South Suburban Gas Company.

[Presidential Address to the London and Southern District Junior Gas Association, Oct. 22.]

Gentlemen,—In opening my address this evening I desire to express my very earnest thanks to the Association for the honour which has fallen upon me in occupying the chair as your President for the session now commencing. I hope to prove a worthy successor to the able men who have previously held the position, upholding the aims and objects of the Association, assisted by an efficient and willing Council, and by the members good attendances at the various meetings and contributions to discussions upon papers and lectures which will in due course be presented before you.

THE GAS INDUSTRY AND THE NATIONAL CRISIS.

Never in its history—now more than a century old—has the gas industry been so closely connected with national affairs as at present. In the extraordinary times now being experienced by all classes, the enormously valuable service rendered the nation by gaseous fuel and bye-products is not, to those who stop a moment to think, difficult of realization. Coal—Nature's most splendid gift—dealt with as is the practice of our industry, is doing yeoman service in the present time of stress. From products essential in the manufacture of explosives, as fuel for all kinds and conditions of metal-working furnaces, in the production of disinfectants and medicines for field and hospital use, for cooking on extensive scales, and in multifarious other ways, the industry has come to the rescue in such manner as must materially assist in determining the grave issues at stake.

ELECTRICITY GENERATION AND RESIDUAL WASTE.

To the gas industry lies the credit of obtaining the utmost value from coal, and utilizing the gaseous and solid products to the best advantage; while, on the other hand, we have ample evidence that our electrical friends and others, by the prodigal waste of these residuals (assisting only to render the air in our towns less pleasant), due to the manner in which the raw material is dealt with, cannot contribute such national service, and with few exceptions continue wasting coal and destroying valuable constituents in a manner which is to be deplored, and, to my mind, is little short of criminal.

COKE FUEL.

When we consider the many valuable bye-products which pass away when coal is utilized as fuel for steam raising, heating, and many other purposes, and the resultant sooty exhalation, which assists in polluting the atmosphere and rendering futile the efforts of architects and builders to produce buildings which shall retain their beauty and newness, it seems somewhat strange that the practice should so long have been indulged in when coke is available—cleanly, of good calorific value, and easy to work with in properly-designed grates and fire-boxes; a form of fuel which is now becoming very popular, and which, while not wholly replacing the coal-fired boiler and domestic coal-grate, will yet go a very long way towards this (from our point of view) desirable end. It will, I am sure, be agreed that this method of heating, with its attendant advantages, has but to become well known to make it generally used for most purposes. The formation of the London Coke Committee must further this object to a very considerable extent, and, by its valuable work and propaganda, create a demand, maintain a steady market, and incidentally perhaps something approaching the good prices that have been the case with gas undertakings during the abnormal past year.

IMPROVEMENTS IN GAS APPLIANCES.

Improvements in appliances for lighting by gas have been most marked during the past few years, and inventors and manufacturers are to be commended for the acumen and ingenuity shown, which has tended to further the sales side of our industry. From the discovery by Welsbach, in 1885, of the effect upon non-luminous gas caused by certain rare metallic earths—although the idea of producing light by heating refractory bodies to the point of incandescence goes back to about 1826, when Drummond experimented with dense lime and an oxy-hydrogen blow-pipe, replacing the latter by discs of magnesia or zirconia; and in 1835 Talbot stated that "paper soaked in a solution of chloride of calcium and burnt in the flame of a spirit lamp leaves a white network of ashes, which, when held in the feeblest alcohol flame, emits a brilliant light" (the latter experiment containing the germ of incandescent gas lighting, and embodying the principles adopted in our own time)—to the discovery of a burner for use with gas under comparatively high pressure, from an illuminating efficiency of 2 candles per cubic foot of gas burned to one of 60, great progress has manifested itself. Nor can finality yet be said to have been reached; and we cannot foretell what the future has in store in this and other directions. So, too, with all other appliances for heating, power, and cooking, advance has been made in remarkable manner and the application of scientific principles involved in construction and design.

GAS-FIRE PERFECTION.

Perhaps the most notable and striking improvement has been in connection with gas-fires, and many firms have devoted a great deal of brains, time, and capital in evolving fires which shall pass successfully certain severe practical tests in order to demonstrate their ability to lead all products of combustion away through the flue-vents, even when unaided by flue draught; while at the same time no appreciable loss in thermal efficiency takes place. Recognizing the importance from a health standard, and appreciating the great boon such fires are to the public, their utility, convenience, and direct effect upon the purity of the atmosphere, medical authorities have interested themselves in this connection; and, as is generally known, one of the journals published on behalf of the medical profession, the "Lancet," has devised an interesting and novel test, bearing its name, which is simple, and requires no special apparatus to demonstrate. The "Shadowgraph" test for hygienic efficiency is also well known, and has, I believe, been adopted by some gas authorities.

One of the objections against gas-fires is that the air of the room does not undergo change so frequently as is the case with the coal-fire. Even this objection, which it appears to me has no place in the mind of the average consumer, has been catered for; and the installation of a gas-fire with double canopy—one section for flue products, the other for vitiated and contaminated air—meets this. It is claimed that ventilation and changes of air in rooms where this type is used are as regular and speedy as with the coal-fire; perfect ventilation being produced. Noisy gas-burners have been overcome; and it is very apparent we are able to-day, with complete confidence and belief, to recommend to all classes of consumers the adoption of modern gas-fires for any position (where flue outlets are provided) and in any circumstances.

From the old unhealthy, noisy, and inefficient fire—which spelt anathema to the user, reduced the water vapour and dried-up the air, gave rise to unpleasant conditions, and did no good to the industry—we have appliances which, besides being ornamental and fit for any room, are silent in operation, and will return in useful and comfortable warmth at least 75 per cent. of the heat energy introduced into them. Certain it is, supported as we are by medical, scientific, and professional authorities, and well knowing that this form of gas-consuming appliance is a creditable addition to the many in our hands, the future appears to be a bright one; and we can, I am sure, afford to be very optimistic in regard to the competition of electricity when introduced for general heating purposes—competition which is to be contended with, although I am of opinion we need not for some long time yet to come regard this form as a serious trade rival in this respect.

ELECTRIC HEATING AND COOKING.

There can be no tangible objection to modern gas-fires with efficiencies such as mentioned, and proved again and again, and the superior ventilating effect and advantage in running cost over the electric appliances. We must, however, remember that the electrical industry, like our own, is for ever experimenting, more especially in the direction of domestic heating and cooking, bringing the latter to such scientific lengths that if ever the ideal electric cooker does arrive, the next difficulty will be to find the cook to operate such a delicate and intricate appliance, which, to be successful commercially, must be constructed to stand the very hard wear and tear imposed by everyday use upon apparatus of this character. The claims made by the electrical industry in relation to heating and cooking are oft-times extravagant, and, dealt with by a capable man representing gas interests, should not be difficult to dispose of. It is not easy to imagine the time when electricity can ever successfully compete with gas for these special purposes, especially when one considers that from the actual thermal units generated about 7 cubic feet of average town's gas are equivalent in heat value to the expenditure of a Board of Trade unit, from which it would appear that current must be supplied at something like ¼d. per unit to ever compete with gas in point view of cost alone, which it will be agreed is certainly not the most important consideration.

THE GAS-COOKER.

The gas-cooker has never been so popular as at the present time, and it is the happy experience of gas undertakings to be able to report large increases in numbers put out from time to time. Scarcely any modern residence on our area of supply is without means of cooking by gas—indeed, it is quite exceptional for new houses to be without them, together with provision for gas-fires.

IMPORTANCE OF THE GOVERNOR.

The present conditions existing relative to lighting show an extensive adoption by the public of the inverted form of burner, having many advantages over the "C" type. In this connection, having regard to the fluctuations which are bound to occur in any line of main, comparable with voltage surges in electrical circuits, especially in those parts of a district where, owing to local conditions, the pressure varies considerably, it is very desirable that a governor of the pressure type be used, having an outlet pressure of something in the neighbourhood of 25-10ths. By this means regularity is assured, and the consumer can depend on evenness of illumination under all conditions. The tendency appears to be in the direction of higher pressures; and in view of this, I believe that at some future time it will be as much the business of gas undertakings to supply either an effectual governor, as part and parcel of the meter, or else a specially governed meter. This annot, of course, be accomplished without capital expenditure; nd rent for an appliance of this character would, I suggest, have o be included with hire terms existing in connection with the eter. The need has already been recognized by some underakings, and governors are installed in many instances. But o be of adequate service to the consumer, steps should be taken o make the practice far more general than it now is.

For some time, as is well known, burners have been upon the arket with fixed gas injectors and air-ports. This is a de-ided step in the right direction. But, at the same time, I enture the opinion that, in order to obtain maximum efficiency, specially in these cases, a governor should be used in conjunc-on with such burners. Consumers, in trying to adjust burners ithout any idea as to the effect alteration of mixture may have pon them, do not usually obtain good results, and are likely o blame the gas itself rather than their interference with the edium through which it is used. When dealing, as we do, with e general public, we must keep before us simplicity as the ruling lea; adequate supply, the "fixed burner," maintenance, and overned pressure forming ideal conditions towards this end.

THE CHEAP BURNER NUISANCE.

The industry has suffered long enough from the cheap burner— product dumped here in the first instance by the Teuton. I ink I am right when I say no respectable gas undertaking will phold the sale of such rubbish, and its adoption by consumers hould be prevented by every means possible. Whatever light-g appliance is introduced, let it be one of merit, good and lasting uality, and a producer of creditable results when in use.

MAINTENANCE.

The question of up-keep of burners is important; and its value not to be over-estimated. When, after a struggle against keen ompetition, a gas lighting installation is obtained and no question f maintenance crops up, it is very disappointing, upon calling t the premises some time later, to find that the burners and lassware have had no attention—consequently being neither fficient nor pleasant to look upon. This is a serious matter, and cases where it exists does much to belittle the undoubted iperiority of gas lighting over any other form of illumination in e minds of the users. It is no advertisement, and is, indeed, kely to prove a factor in losing business. In all cases special fforts should be made by the gas official to obtain instructions r maintenance when an order for fittings is obtained. By this eans, and subject to a skilled man being employed, one may be ssured that any lighting installation will remain quite satisfactory nd give no cause for complaint. The consumer is occasionally ifficult to convince in this connection, appearing to think that nce a burner is installed it will retain its cleanliness and effi-ency *ad infinitum.* In cases where it is not possible to persuade im to adopt maintenance, it is wise to offer facilities for a free ial; so that, by practical demonstration, he may be led to allow e gas company to continue the service. On the other hand, though nothing is more simple to keep in order than an in-andescent burner, he should be offered facilities for the tuition ecessary, and have an opportunity of examining a burner and arts. Maintenance must be regarded as of the greatest conse-uence in determining the value of service rendered in the distri-ution of gas.

All appliances should be efficiently looked after in this respect -whether the property of the consumer or on hire. I do not think e can look to the consumer to pay much attention to fires, radia-rs, boilers, &c.; and although considerable expense is involved carrying out a free maintenance (of all appliances) scheme, the utlay would be compensated for in large measure by the addi-onal output which would accrue, due by reason of the satisfac-on experienced by consumers in using appliances which effi-ently do their duty and are always ready for use, and leading extension by the further adoption of labour-saving gas con-uming devices.

TRAINING THE GAS-FITTER.

At no time has so much attention been directed to the gas-fitter s the present, nor have so many opportunities previously been vailable for the acquisition of theoretical and practical knowledge. he industry is fully alive to the importance of this; and in con-unction with various educational bodies throughout the country, cellent facilities now exist for the organized training and equip-ing of this most important branch—one which has far-reaching fects; for by the quality of the work done resultant efficiency nd practicability are effected, and consumers tend to be influ-nced to a great extent by the way in which their requirements re carried out.

It is common knowledge that the gas-fitter of yesterday, unless e takes advantage of the opportunity, cannot hope or expect to eep pace with the younger generation springing up. The day hen work could be done haphazard, "take it or leave it," has ng since passed, besides which the requirements of modern gas ork are far more comprehensive than those existent some years go. I believe the average fitter recognizes this; and now that ractical tests, followed by examination, have been established, ne hopes to see, and indeed anticipates, a very keen interest and pplication in the future. Every encouragement is offered; and a man does not realize this, it is his own fault should he drop ehind, as undoubtedly he will.

Good progress in the scientific application of gaseous fuel has een made, and with it appliances of a more or less intricate character evolved. The production of hot water by means of gas is comparatively new, and will increase in importance as time goes on. High-pressure lighting and heating, modern burners, fires, geysers, and the hundred-and-one smaller appliances designed for use in the domestic and factory spheres, all represent some special train of thought on the part of their designers, and, accordingly, to produce the desired results must be understood and fitted in the correct way. An up-to-date fitter, to rank "first-class," must of necessity be *au fait* with the use, design, and capabilities of modern apparatus. The laying of supplies and the fixing of fittings and appliances, the correct sizes of pipes to instal, and so on, may be easily understood; but of what advantage is this if, when an apparatus is installed, the fitter is unable to correctly adjust or explain it?

In thus remarking upon the practical man, mention should be made of the gas official—canvasser, inspector, or foreman. He is usually in charge of, or responsible for, the carrying out of work; and it is absolutely essential that he keeps himself up to date and have a clear conception of the advantages and limitations of all new devices. In contact with the consumer, he acts in an advisory capacity, and in most instances his word is taken regarding the capability, use, advantage, and economy of the particular appliance in view and the desirability of adoption. He must therefore know these things—and not only from a theoretical, but also, whenever possible, from a practical standpoint. As with other branches of the industry, classes, lectures, and demonstrations are open to him, and should be taken full advantage of.

PRACTICAL DEMONSTRATIONS AND ENCOURAGEMENT.

In conjunction with these, I would suggest, for the consideration of those interested, the formation of a permanent exhibition on the works of an undertaking large enough to warrant it, open to employees only, in which every piece of apparatus adopted for sale or hire by the particular company is placed on show (preferably in section) for a time, and periodical meetings of distribution officials, foremen, and fitters held, under the direction of a thoroughly practical member of the staff who is in a position to dilate upon the merits of the appliances exhibited, explain the special features and methods of fixing, and invite questions and discussion thereon. The cost of such a scheme would be trifling, the co-operation of makers unquestioned, and great benefit would accrue, not only to the undertaking itself, but to the staff generally, and certainly in the long run to the consumer.

I regard the present time as a splendid opportunity for the fitter; and he seems to be "coming into his own." It is, however, the duty of those in control to encourage him to better himself; and the chief who does not use his best efforts to persuade those under him to further increase their knowledge, and, by advice, assist to this end, is not contributing his best service to the company he represents. The mere fact that a man holds one position to-day is no criterion that he will not occupy a more responsible one to-morrow—indeed, the industry is in need of men who show, by sheer merit and application of purpose, the desire to do better in their respective spheres. I believe the technical men of the future will be largely drawn from those fitters who are wise enough to realize the opportunities which are now before them. With the growth of the industry and the expansion of the uses to which gas is now put, and the competition of other forms of energy, the institution of special departments has become most necessary to deal in a proper manner with the many intricate questions arising in the sale of gas. Administrators have long recognized that it is one thing to make gas, but quite another to sell it; and while the manufacture of good gas forms the foundation upon which the reputation of the industry is maintained, it cannot be gainsaid that it is from the ever-expanding increase in output that dividends are made.

PUSHING SALES.

Special attention must therefore be given to means whereby such outlet may be extended. The formation of canvassing and sales sections, having at their heads specially trained commercial men, staffed with capable and trustworthy officials, has assisted to place the industry in a sound position, and, while creating the demand, caters for the needs of all classes of consumer, bringing home the advantages of the use of gas for all purposes—industrial and domestic. Advertising through the Press is excellent in its way; but to effectually reach the consumer there is absolutely nothing to come up to the personal call. An engaging manner, expert knowledge of the subject, and a desire to satisfy, do more than reams of pamphlets and circulars, which I very much fear generally find their way into the waste-paper basket. The personal element is essential; and its value is not to be equalled by any other means.

GAS-HEATED HOT-WATER SUPPLY.

In connection with expanding sales of gas, new fields for which are ever opening up, an excellent opportunity is found in areas —and there are many—where, by reason of added railway and tram facilities, the large old-fashioned houses are converted into flats, catering for the smaller consumer. In these instances it is found that, by such conversions, three or four consumers are placed on the books of a gas undertaking where only one used to be registered. A special outlet for gas consuming appliances is thereby created, and chance given to introduce, among other things, especially the gas-heated boiler or "circulator." It is, however, advisable that all gas consuming appliances of this character should be automatically controlled—the consumer being thereby relieved of the necessity for special attention, and the chance of an unduly high gas account very much minimized.

We have only touched the fringe of gas-heated hot-water supply; and provided always special attention is given to each and every installation—so producing satisfactory conditions, economy in running cost, and convenience in use—there is no reason why this comparatively new outlet for gas should not prove of great and increasing value to all progressive undertakings. Certain it is that, provided the special attention to which I have referred is devoted to this branch, installations of gas-heated boilers will, in common with all other appliances giving satisfactory service, advertise themselves. A consumer who is perfectly contented with any apparatus of domestic utility which is labour-saving and bears out in a practical manner all that is claimed for it, does not hesitate to expound upon its merits to his friends, with the result that, in many instances, an inquiry is received by the gas department, which, being followed up, makes another consumer.

There is, of course, another side to the question relating to ill-fitted and inefficient appliances, upon which it will serve no good purpose to dwell; my only idea being to draw attention to the need for specialization and for inquiry into each individual case. Hot water departments are becoming general among gas undertakings, and must increase in importance as time goes on. Where, by reason of some special circumstance, it is found inadvisable to introduce a gas-heated water system, the consumer should be frankly and diplomatically dealt with, and an endeavour made to persuade him to adopt a coke-consuming appliance, thereby retaining him as a customer for this class of fuel.

THE POSITION OF THE COLLECTOR.

It has been suggested more than once that the collector should assist in pushing the sale of gas in the course of his everyday employment, and, in fact, become what is to all intents and purposes a canvasser for his company. While, however, recognizing the fact that at all times a word in season from any official of an undertaking is of value, and may lead to business—and this should always be borne in mind—it does not seem to me possible that the collector is able to devote any time at all to discussing such matters with consumers. The collector has enough to do with the business on hand; and should he be called upon to add any further responsibilities to his ordinary duties, something would have to suffer. I would rather suggest that, coming into personal touch with practically all consumers on the books of an undertaking, and having exceptional opportunity for conversation, he should be instructed and expected not to advise, but to make a note of any particular request or query set up, and refer it to the department whose business it is to deal with such matters, and, indeed, regard this as part of his duty.

Considerable work is imposed upon the collector, and although in many instances accounts are paid at the local show-rooms (a very desirable proceeding), he has quite enough to do, and should be left to do it rather than asked to take up matters requiring special knowledge and experience. A speaker at a recent meeting gave as his opinion that the collector should be gradually eliminated; the collection of accounts not being necessary, due to the habit of paying into show-rooms. This appears, however, hardly feasible; for, after all, there are many queries and questions raised which only the personal call can settle, and it is not to be expected that all consumers will visit offices to pay accounts, although encouragement should be given them so to do in view of interest becoming aroused and the existence of new appliances pointed out.

MEETING ELECTRICAL COMPETITION.

It would be futile not to recognize that competition between all forms of heat energy will become more acute as time progresses; and it is therefore imperative that we should put our shoulders to the wheel, and, realizing that greater knowledge and application are demanded of us, seek to obtain it by every means in our power in order to successfully cope with new conditions that from time to time may arise. It is not sufficient to know all about one's own profession or trade; for, without some knowledge at least of the practice of competitors, one is at a discount and not able to contribute service of the greatest value. The study of the *pro* as well as the *con* must produce a convincing manner, and in contact with the consumer or customer greatly assist in effecting the desired end.

Especially is this so regarding gas and electricity—two forms of energy which are productive of like results, and between which, from the point of view of the general public, influenced there is no doubt largely by advertisement, but little difference appears to exist. In practice, however, great differences do exist, as we well know, and not from the standpoint of running cost alone. It is the business of those engaged in outdoor departments to bring out, and place before potential consumers, the relative values, ultimately securing them to ourselves for lighting, heating, cooking, or power. We are in a position to go to the consumer and say: "Adopt our form of energy and whatever you use you pay for, and nothing more." On the other hand, it is, I believe, somewhat common practice for electrical undertakings to obtain signatures to agreements for fixed sums per quarter whether current is dissipated or not. This appears to be a most unsatisfactory method of doing business.

The electrical industry is also burdened by a large number of special rates. To mention but a few, we have: Maximum demand, rateable value, contract demand, Metropolitan, telephone, differential rate, Glasgow, and others, all of which must at times create some confusion, nor be always satisfactory to seller and buyer. Flat-rate per unit, based on consumption of current only, appears to be, from a consumer's standpoint, the only correct one, although, of course, the electrical supplier has good reason to think otherwise. In our capacity as technical representatives, we should have some knowledge of matters of this character, and also be thoroughly conversant with the nomenclature common to the industry. At a future time I may be privileged to further explain in detail such rates.

EFFICIENCY.

Before concluding, I should like to make a few remarks upon a subject which is, I am afraid, becoming a little well worn, having especially engaged the attention of a number of gentlemen who appear to think that most industries in this country are suffering from lack of organization and correct business methods, known under the name of "efficiency." It will be agreed that to produce a sound state of affairs in any undertaking of public service, it is a *sine quâ non* that all departments inside and out should be coherent and act together as a whole. The labour of any one section is to a large extent nullified or reduced in value if these conditions do not exist. Efforts must be made by those in authority to effect smoothness of working and unity of purpose; and in addressing a body of men some of whom already occupy positions of responsibility, and others who will in due course control departments of importance, I venture the opinion that the development of character, a kindly and tolerant manner, and sympathetic treatment exercised towards those with whom we come into contact in our various spheres are of inestimable value to those whose representatives we are, and tend in great measure to produce a high degree of satisfaction and efficient results. I am afraid we sometimes take little heed of the psychological aspect of business life; but it is a powerful factor in determining a man's fitness for the position he may occupy, apart from consideration of the knowledge required. After all, "The mind's the standard of the man," and the reflection of his character in those around him is a measure of his worth.

VALUE OF THE JUNIOR ASSOCIATIONS.

The Junior Associations occupy to-day an excellent position, and have, indeed, become an important feature in the gas industry, encouraging the younger members of the profession to come forward and give of their best for the common good. It will I am sure be agreed that many advantages accrue from membership—the reading of papers, engaging in discussions, lectures, and visits to the many interesting works and factories thrown open with such great liberality by managers and manufacturers (often at considerable inconvenience to themselves), embracing as they do all the branches of the gas and kindred industries, serve an extremely valuable purpose in broadening the views of the members, and, coupled with earnest attention to their everyday work, fit them for higher and more responsible positions, and assist towards a realization of their ideals.

GAS MANUFACTURE AND HIGH-PRESSURE DISTRIBUTION FOR SMALL TOWNS.

THE TENNEY PROCESS.

By Ralph B. Wagner.

[A Paper read at the Twenty-Fourth Annual Meeting of the Michigan Gas Association, Detroit, Sept. 23.]

The Tenney process is designed especially for supplying gas to small towns, either isolated or in conjunction with other small towns connected by high-pressure mains to the one manufacturing plant. It is chiefly applicable to towns where the cost of the ordinary systems of coal or water gas manufacture and low-pressure distribution would be prohibitive—in fact, the largest community at present supplied with gas by a Tenney plant has a population not exceeding 15,000 people. Tenney plants are designed to economize in both installation cost and in operating expense. They were first installed in the smaller towns throughout Iowa and Nebraska. Because this particular process differs in many interesting details from the systems generally employed in the gas plants throughout Michigan, it was thought a brief account of the process would be interesting to members of the Association.

The term "Tenney Process" in its strictest sense should only be applied to Mr. Tenney's process of manufacture of gas, as the high-pressure storage and distribution principles employed by him are to-day commonly used by a majority of all newly-constructed gas companies, regardless of their process of manufacture. A brief description of the high-pressure storage and distribution methods employed by Mr. Tenney will not be out of place, however, as he (possibly more than any other one man) has experimented with, and brought out the merits of, high-pressure storage and distribution.

Manufacture.

The Tenney process of gas manufacture is a system of carburetted water-gas manufacture, identical in principle and gas composition with the Lowe system. Instead of having the generator, carburettor, and superheater in separate shells, however, the enney system combines all these stages in one shell. This shell rectangular in shape, 16 feet long, 5 feet wide, and 12 feet high. t is built of ¼-inch steel, lined with fire-brick. A 60 H.P. waste-eat boiler, placed on top of this shell, constitutes the cover of the enerator proper. Heavy fire-clay tile protects the belly of the oiler against the excessive heat of the generator. All blast gases nd carburetted water gas leaving the superheater pass out and rough the fire tubes of the waste-heat boiler. Thus the boiler cts as a primary condenser to the water gas; and it is claimed at an economy is effected, due to the fact that no shock is given e gas by plunging it into the water of the hydraulic seal without rst reducing its high temperatures. Enough heat is generated this way to operate the blower for the generating apparatus, nd also to drive a 50 H.P. duplex, cross-compound gas-compressor. he exhaust steam from the compressor can, by turning a three-ay valve, be run into the superheater. In this way the apparatus can be operated without drawing to any considerable extent n the live steam from the boiler. An additional fire-box placed the back end of the shell supplies the necessary steam to drive e blower while the machine is being warmed-up.

The piping to the oil-storage tank is so arranged that the pres-re in the gas-storage tanks can also be transmitted to the oil-orage tank, and this gas pressure forces the oil into the enrich-g chamber.

Similarly to the Lowe process, in the Tenney system the gas npties directly from the generator into a relief holder; and from is point, the gas is drawn by the suction of the compressor rough the scrubber, washer, and purifiers, and is then com-essed into the high-pressure storage tanks.

In designing the scrubbing, washing, and purification apparatus d pipe-line, provision is made so that all this apparatus can be sed in connection with coal-gas benches; so that if the price of l becomes prohibitive, the entire plant can be made into a high-essure coal-gas plant by the addition of coal-gas benches.

Pressure gauges are placed on a gauge-board to record the essure on each storage tank; and a recording time gauge is aced in each office to show the pressure on the mains through ery hour of the day.

The results achieved from the Tenney process of manufacture e very satisfactory. To make and compress 1000 cubic feet of o B.Th.U. gas requires an average of 4 gallons of gas oil and lbs. of combined generator and boiler fuel. In the latest enney plant an automatic charging device is being used. With is device one operator is sufficient to operate a plant supplying town of 4000 people. At night the plant is closed and locked , so that only one shift is required.

STORAGE.

Whenever a complete Tenney plant is installed, high-pressure orage tanks are used entirely for gas storage. These tanks are feet in diameter, approximately 40 feet long, and are built of and ½ inch steel. The gas is stored in these tanks under pres-re varying from several pounds above atmospheric pressure to lbs. and even 90 lbs. per square inch.

The pressure causes a precipitation of the moisture in the gas, d also precipitates the lighter hydrocarbon gases. These tter form an extremely explosive liquid, commonly called "bug-ice" by the operators of Tenney plants. A container is buried side the storage tanks for the purpose of draining the water and is explosive liquid from the storage tanks. The water settles the bottom of the container, and is drawn off from time to time; hile the explosive liquid is allowed to accumulate until it backs- into the storage tanks, where it is drawn through the governors t into the mains by the outgoing gas. In the mains, where the essure is usually about 2 lbs., the gas, because of the released essure, has the capacity of re-absorbing this explosive liquid. this way, the gas loses very little of its high heat constituents, t loses its water vapour entirely.

These high-pressure storage tanks have a capacity of approxi-ately 10,000 cubic feet, under a pressure of 80 lbs. per square ch. Where a storage capacity of 100,000 cubic feet is desired, n of these tanks are ranged in parallel, side by side, on con-ete piers. Two systems of valves are so arranged that all the nks can receive or give out gas at the same time, or any one or everal tanks can be cut off from the remaining tanks.

The pressure is reduced by two systems of governors. The st governor reduces the pressure from the storage tank pressure 10 lbs., and the second governor reduces it from 10 to 2 lbs., hich is the pressure commonly carried on the mains.

This is not a discussion of the relative merits of high and low essure storage; but, in connection with the above description, e following advantages of high-pressure storage in small plants ay be enumerated.

1. High-pressure storage tanks having a capacity of 10,000 bic feet each under a pressure of 80 lbs. can be installed in ace for a cost not to exceed $750 per tank; so that for storage pacities of less than 150,000 cubic feet, the initial cost of high-essure storage is considerably less than that of low-pressure orage of the same capacity. In addition, if waste-heat boilers e employed, as in the Tenney process, the cost of compression almost *nil*, and the above becomes a distinct advantage.

2. The extreme flexibility of the storage unit when high-pres-re storage tanks are used is a distinct advantage. In a small ant, it is very common to instal at first a holder of 40,000 or ,000 cubic feet capacity. If the town grows, or if the business evelops more than normally, it is necessary to build another large holder. On the other hand, with high-pressure storage tanks the storage capacity can be increased by units of 10,000 cubic feet each.

3. The depreciation on high-pressure storage tanks is almost negligible—the life of these tanks being practically indefinite.

HIGH-PRESSURE DISTRIBUTION.

The Tenney method of high-pressure distribution differs in no marked degree from most other high-pressure distribution systems now extant. Standard black pipe, tested to 1200 lbs. pressure, is used for the mains. The sizes of pipe used are usually 3-inch, 2-inch, and 1½-inch. Where fifteen miles of pipe are required to pipe a town, approximately three miles of 3-inch pipe, seven miles of 2-inch pipe, and five miles of 1½-inch pipe are used—making the average cost of piping a town equal to piping the entire town with 2-inch pipe.

All fittings used at street intersections—such as crosses, elbows, and tees—are "Dresser" expansion fittings with rubber gaskets. In high-pressure transmission lines connecting two or more communities, where the pressure exceeds 10 lbs., lead-tipped gaskets are used in all expansion fittings. In long stretches of pipe line, a "Dresser" coupling is used every 1000 feet, providing that no other expansion fitting has been used in this distance. Recessed couplings, with a coating of red lead, are used in connecting all the pipes.

Every joint is subjected to an air test of at least 50 lbs., even though the line is not expected to carry more than 5 lbs. gas pressure. "Drips" are placed in all low places in the pipe line, to remove water that might accidentally get lodged in the line.

The pipe is laid at an average depth of 30 inches below the surface; this being found deep enough to protect the pipe from traffic above. Where there is no likelihood of the service-pipes being disturbed, they are often laid just below grass-roots. Service-pipes are often run on the outside of brick walls in order to reach upstair offices. In the winter these pipes are often covered with ice and snow; but, owing to the extreme dryness of the gas, a "freeze-up" is almost unknown. Service-pipes of ¾-inch are used almost altogether.

In laying these high-pressure distribution systems it is very seldom indeed that a pavement is disturbed. Whenever it is necessary to cross a pavement the pipe is pushed underneath the path by means of a pushing-jack. Pipe can be pushed successfully in this way for a distance of 200 feet. Wherever possible the pipes are laid in alleys, or if there are no alleys they are laid in the parkings on either side of the pavement, rather than tear up the pavement.

In connecting small towns of 3000 or 4000 population a 2-inch line is used as a transmitting line; the gas being forced through at a pressure varying from 20 lbs. to 70 lbs. At the town to be supplied, storage tanks and governors are placed to store the gas, and reduce the pressure in the same way as at the main plant. These storage tanks are provided with check-valves, so that if a break should occur in the cross-country pipe line, the gas cannot leave the storage tanks. This is an important point in the promotion of good service for small communities supplied from one central supply station.

The chief advantages of high-pressure distribution are: 1. The very low installation cost—the average cost of the pipe line, laid and completed, being less than $1000 per mile. 2. A constant, uniform pressure at every house, whether situated 100 feet from the gas plant or located 10 miles distant from the plant. 3. Immunity from "freeze-ups" during the winter months. 4. A very clean and dry gas that gives the best of satisfaction for both cooking and lighting. 5. The possibility of using gas under practically any pressure that may be required for industrial appliances, high-pressure lighting, &c.

NATIONAL ILLUMINATION COMMITTEE OF GREAT BRITAIN.

Affiliated to the International Commission on Illumination.

A Meeting of the National Illumination Committee of Great Britain was held at the Institution of Electrical Engineers last Wednesday, when it was reported that Mr. Jacques Abady had been nominated by the Institution of Gas Engineers as a member of the Committee to fill the vacancy caused by the death of Mr. Edward Allen, of Liverpool. The Committee elected Mr. W. Duddell to be its Chairman, in succession to the late Mr. Allen, and Mr. John Bond, of Southport, to succeed Mr. Duddell as one of the Vice-Chairmen.

Reports on observations carried out at the instance of the Committee at a number of technical laboratories, on the height to which the flame of the Hefner amyl-acetate lamp should be raised to afford a light of one International or English standard candle, were discussed, and their further consideration was postponed until fuller details of some of the observations and other records which had been promised had been obtained.

A report prepared and sent by Dr. E. Ott, of Zürich, on researches which had been carried out in Switzerland on the effect of atmospheric pressure, humidity, and vitiation on the light afforded by the Hefner standard lamp, was considered; and it was decided (subject to Dr. Ott's consent being obtained) to prepare a translation of the report for communication to the English Technical Press.

As a result of the alterations noted above in the *personnel* of the Committee, the following is the complete list.

Chairman:
W. Duddell.

Vice-Chairmen:
John Bond and A. P. Trotter.

Secretary and Treasurer:
W. J. A. Butterfield.

Committee:

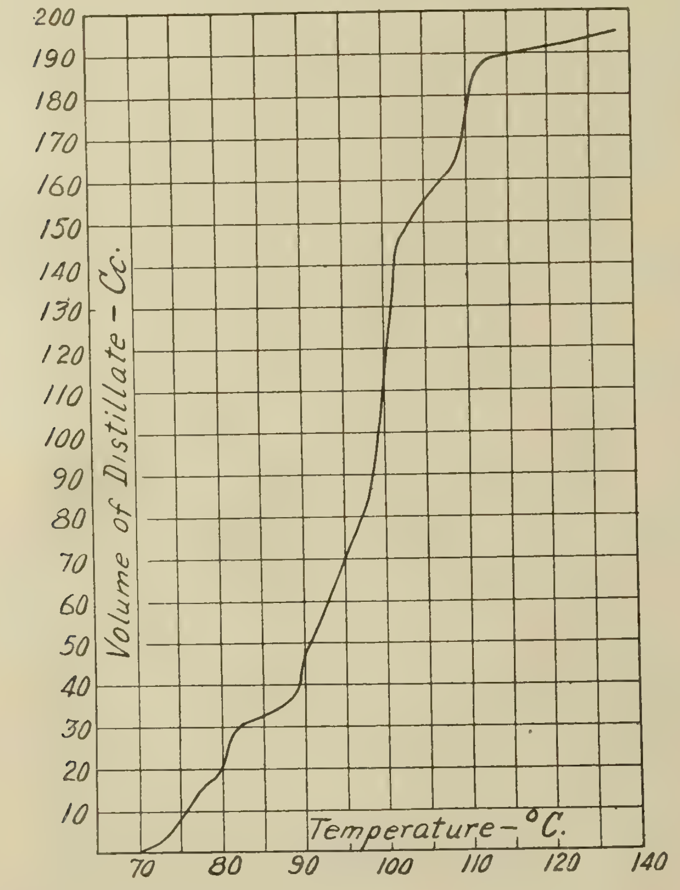
Jacques Abady (*c*).
Frank Bailey (*b*).
John Bond (*c*).
W. J. A. Butterfield (*c*).
Harold G. Colman (*c*).
W. Duddell (*b*).
Kenelm Edgcumbe (*b*).
Leon Gaster (*a*).
R. T. Glazebrook, C.B. (*d*).
F. W. Goodenough (*a*).
Haydn T. Harrison (*b*).
James Kerr (*a*).
J. T. Morris (*b*).
Clifford C. Paterson (*d*).
Silvanus P. Thompson (*a*).
A. P. Trotter (*a*).
Robert Watson (*c*).

(*a*) Nominated by the Illuminating Engineering Society.
(*b*) ,, ,, Institution of Electrical Engineers.
(*c*) ,, ,, Institution of Gas Engineers.
(*d*) ,, ,, National Physical Laboratory.

Representatives of Great Britain on the Executive Committee of the International Commission on Illumination:
Harold G. Colman and W. Duddell.

CONDENSATION FROM CARBURETTED WATER GAS.

Writing to the "Journal of Industrial and Engineering Chemistry"—the organ of the American Chemical Society—Mr. E. T. Sterne, of the Gordon Hall of Chemistry, Kingston, Ontario, gives some particulars of an examination he made of a sample of a condensate which was formed during a very cold winter several years ago in the service pipes of the local gas-works. The liquid was of a pale amber colour, with rather a sharp odour, and a specific gravity of ·740. The plant manufactures carburetted water gas, using anthracite coal in the generator, and Pennsylvania crude petroleum in the carburettor.



The liquid proved to be composed of low-boiling point compounds—95 per cent. distilling below 120° C., and 99 per cent. below 130° C. The sample was fractionated carefully in order to locate individual compounds in substantial amounts, which would make their presence known by irregularities in a curve plotted from the results.

The fractionation was made using a twelve-pear still head, and collecting the distillate in 2° fractions. The accompanying curve shows the boiling point to rise very regularly with the exception of breaks at 80° to 82°, 98° to 100°, and 110° to 112°. In order to obtain an idea of the relative amount of unsaturated hydrocarbons in the different fractions, the bromine absorption was determined in the combined distillate for each 10°. Excess of a *N*/10 solution of bromine in carbon bisulphide was allowed to react in the dark on 1 cc. of each of the undermentioned fractions for fifteen minutes. The excess of bromine was titrated with *N*/10 sodium thiosulphate.

Fractions.		G. Br. Absorbed by 1 cc.		Fractions.		G. Br. Absorbed by 1 cc.
70–80°	..	0·00950	..	110–120°	..	0·00820
80–90°	..	0·00930	..	120–130°	..	0·01580
90–100°	..	0·00875				
100–108°	..	0·00827	..	Original	..	0·0114

If it is assumed that the unsaturated is due to dodecylene boiling at 96°, the percentage of unsaturation is

$$11{\cdot}4 = 168/160 \times 1/740 = 1{\cdot}62 \text{ per cent.}$$

The fraction boiling at 108° to 112° was redistilled, and 1 cc. of that which came over at 111° was nitrated and toluene identified. The whole fraction 108° to 112° compared very well with commercial toluene.

The paraffins and olefines were estimated by using dimethyl sulphate, which gave 77·5 per cent. of paraffins and olefines undissolved. The composition of the sample works out thus:

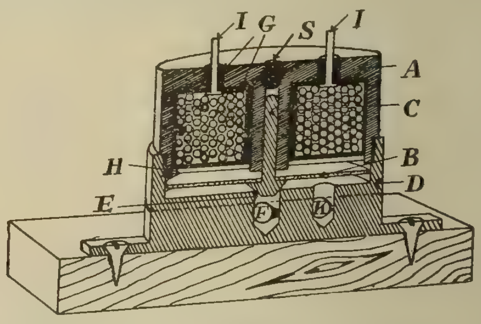
Paraffins.		Olefines.		Aromatic.		Total per Cent.
75·88	..	1·62	..	22·5	..	99·90

The quantity distilling at 78° to 82° was about 12 per cent., corresponding to benzene mainly; that at 108° to 112° (corresponding to commercial toluene) being about 10 per cent.

The above results led the author to conclude that the possibility of producing toluene on a commercial scale during the manufacture of carburetted water gas may be not unreasonable. It would probably involve some method of condensing or absorbing the toluene along with the benzene and other compounds, and the subsequent separation of these compounds—retaining the toluene and returning the others for illuminating and heating purposes.

ELECTRICALLY OPERATED GAS-STOVE VALVE.

The October issue of the "Journal of Industrial and Engineering Chemistry," publishes a description received from Mr. Zeno Ostenberg, of San Francisco, of a simple electrically operating gas-valve used to regulate the flame of a double-burner gas-stove, which heated a large water-bath, 24 inches in diameter. Since two of the appliances have been in operation for over a year-and-a-half, with entire success, it was thought that a description and illustration of the mechanism would be useful to others.



The mechanism consists essentially of an "ironclad" electromagnet A, which lifts the iron disc B to which are attached the brass valve and stem C. This makes a gas-tight fit with the main brass body D at the inlet E when no current is passing through the magnet-winding. But when current is sent through, the disc B and valve C are raised; and thus gas is allowed to pass from E to K, which leads to the burner. F is the outlet to a pilot light. The disc B is prevented from sticking to the magnet by the plug S, which may be screwed down to limit the travel of the valve-stem C. G is insulation, which must be able to withstand a rise of temperature up to about 100°, as the magnet sometimes becomes quite hot. The disc H is of brass, and is soldered gas-tight to the magnet to prevent moisture and gas from attacking the wiring and also to keep the wiring in place. The gas inlet tube [not shown] enters opposite to the pilot opening F. When operating from a 110-volt line, the winding consists of No. 26 copper wire with a 16-candle power carbon lamp in series. This allows slightly less than 0·5 ampère to pass the electromagnet.

The electrical circuit is opened and closed by a 75 ohm standard Pony relay, which is operated by a dry battery and thermo-regulator. The dry batteries, which were originally put into the thermo-regulator circuits over a year-and-half ago, are still able to operate the relays, as only about 0·02 ampère is used; and this amount of current is so small that no trouble whatever has been experienced from oxidation of the mercury at the contacts in the thermo-regulators.

Obviously the valve may be used on any size of burner, from the smallest micro-bunsen to one which has a gas inlet equal in size to the inlet and outlet of the valve. In the valves in use, these holes are 0·25 inch in diameter.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

Opening of the Session.

The session of the Scottish Junior Gas Association (Western istrict) was opened on Saturday last, in the Royal Technical ollege, Glasgow. In the absence of Mr. Thomas Carmichael, e retiring President, Mr. John Wilson, of Falkirk, presided.

Installation of the New President.

The Interim Hon. Secretary, Mr. Littlejohn, read a letter om Mr. Carmichael, expressing regret at his inability to come orth.

The Chairman said that Mr. David Fulton, their new President, eeded no introduction. He had been an official among them for many years that if they did not know him it was entirely their wn fault. He now occupied a recognized position in the gas rofession, and he thought they ought to congratulate him on is keeping up his connection with the Juniors, as those who had one before had not always done.

The President (Mr. David Fulton), having been duly installed, emarked that it said very much for the vitality of the Association at they had been able to prepare a syllabus in a year like the resent. They had been able to secure Professor Arthur Smithells, Leeds, to deliver their annual lecture. Mr. Fulton then read e following

PRESIDENTIAL ADDRESS.

Gentlemen,—I have to thank you for the honour you have conerred on me by electing me your President. Though perhaps I n no longer technically a Junior, I am indeed proud to be the resident of this Association, for I feel that whatever slight sucess I have achieved has been in no small measure due to the ducative and inspiring influence of the Association.

The Association is now entering its twelfth session; and it ust be said that its success has far exceeded the fondest hopes its sponsors. It might have been thought that through time ere would have been produced a sterility of new ideas for apers; but the contrary seems to be the case, as the quality of e papers has been well maintained. A very valuable aspect of ese Associations is the opportunities which the members have informal chats regarding their troubles and difficulties with thers having special experience. I cannot conceive how any oung man with one spark of ambition in his composition can e so blind to his own interests as to remain outside the ranks.

Though the time is not propitious, I should like to refer here one of the objects of the Association which so far has not atured—that is, the founding of a library. Through the kindess of the Royal Technical College authorities, the members an have access to the College Library on the same conditions as ollege students. This privilege is not taken advantage of as it ould be, possibly because the library contains few gas handooks. A library under the ægis of the Association would peraps be more accessible; and I venture to hope that the matter ill not be lost sight of when happier times return.

When we parted at the early part of the summer, we hoped at before the opening meeting of the current session our forces ould have emerged victorious from the most tremendous and rrible of all wars. However, we unfortunately find that, though reat things have been accomplished, there is no hope of another inter campaign being avoided. I was somewhat doubtful as to e policy of holding our meetings; but the Council felt that those embers whose path of duty lay at home would be glad of an pportunity of occasionally meeting in the usual way. Therefore, somewhat restricted session was arranged. I know that the oming winter will be fraught with trouble, and it will not be easy r many of you to get away to attend these meetings. Nevertheess, I trust you will endeavour to be present as often as possible, nd so help to preserve that life and enthusiasm so characteristic the Association in the past.

THE ASSOCIATION'S ROLL OF HONOUR.

The Association "Roll of Honour" contains the names of 28 embers serving with His Majesty's Forces. The number is ery creditable to the Association, and these members are to be ongratulated on having sacrificed everything to answer their ountry's call. One member has fallen on the field of conflict. Ir. John Craig was killed in France on Sept. 18. In communiating the news of his death to a friend, his officer said: "He as a good soldier." I do not know that any man could desire a ner epitaph. We sincerely regret the loss of a young life; but it no small thing to have fought the good fight, and died in the ause of right. Mr. William Scott was wounded in France, but as now happily quite recovered from his wounds.

TRAINING GAS-FITTERS.

During the past three years or so much has been said and ritten regarding the training of gas-fitters; and action has folowed talk, with the result that we have now in many towns a efinite scheme for the practical and technical education of gasters, and also a definite scheme of examination and certification. his undoubtedly is all for the profession's good, for the more the tter knows of the scientific principles underlying the proper use gas, and the purpose and application of the apparatus he is dealing with, the better is he able to assist in advancing the cause of our industry.

QUALIFYING FOR THE GAS PROFESSION.

The training of young men for the position of gas manager has also received spasmodic attention; but, unfortunately, no action has followed. And as it appears to me that the present system, or lack of system, is woefully haphazard, it is on this point, and on the certification of gas managers, that I wish to have a talk with you.

If the proper type of men required by the great and ever-increasing needs of our profession is to be brought forward, then it is necessary that some definite scheme of training and guidance in study should be instituted. It is in the early years of his career, when his brain is receptive and retentive, that the young man of fair education joining the gas profession as a career should receive that training and education which will form a firm foundation on which experience will surely build. It is bad, and against the interests of the profession, that young men desirous of increasing their knowledge should be allowed to drift, instead of being directed on a definite course.

Mr. Thomas Glover, the kindliest of men and least harsh of examiners, in his 1912 review of the City and Guilds examinations in Gas Engineering, commented on the number of candidates who presented themselves very inadequately prepared for the test, and suggested the institution of preliminary examinations in chemistry and mechanical engineering. Now this unpreparedness is not altogether the blame of the student; some blame must be apportioned to lack of guidance and educative facilities. Young men keen enough to desire the certificate would not present themselves without having devoted energy to gaining knowledge; and it is a pity that effort should be wasted because their training and studies are not directed on right lines.

At the very outset of his career, a young man should have a definite scheme of apprenticeship laid down for him to follow, so that he will acquire sound knowledge of the various branches of his industry, and not be compelled to pick up in a second-hand way knowledge of a department with which he will never come directly in contact. I do not say that none ever have these opportunities; but it is not so in the majority of cases. The courses of technical study should be arranged to coincide with the practical training received; and instead of beginning with classes in gas manufacture, the student would begin with the study of those allied sciences on which the science of gas manufacture is founded. A young man would then have the certainty that if he made full use of his opportunities he would, when his apprenticeship was finished, be qualified to take an assistant's or other subordinate responsible position in a gas-works, which in time would lead him to the desired goal.

The gas manager of to-day has to have, broadly speaking, knowledge of chemistry, engineering, and business methods, with which subjects his industry is bound up. A young man has therefore no time to waste in flitting about seeking where he may begin, and studying in a desultory fashion, with but the haziest ideas of his ultimate object. At the very beginning his course should be set and his studies directed on settled lines.

For the teaching of the technical subjects—chemistry, physics, and engineering—good technical schools exist in practically every district, and commercial subjects are taught in every evening school. So far as gas manufacture and gas supply classes are concerned, I think these subjects are taught in only two technical colleges in Scotland—Glasgow and Edinburgh; but the students to whom they are inaccessible may avail themselves of any of several good correspondence classes. The machinery is therefore at hand; what is wanted is the introduction of a systematic course of study, combined with less divisional and more general works' experience; for, after all, all the school study in the world is incomplete without correlative practical experience.

Referring to the only "Gas Manufacture" and "Gas Supply" classes accessible to the members of this Association—those of the Glasgow Royal Technical College—I think that it would be a great advantage if to the theoretical instruction received in the lecture room, practical demonstration in the laboratory could be added. The syllabus should also be arranged to conform more to the requirements of the City and Guilds examination; for meantime the City and Guilds certificate is the only one for which a student may try. I do not know if there is a representative of the gas profession on the College Board, but there certainly should be one to advise and assist in making these classes thoroughly useful to the students. Mr. J. B. Scott, in his excellent Presidential Address to the North British Association of Gas Managers, suggested the institution of a central laboratory where gas managers could have experimental work carried out. This object might be achieved by setting up such a laboratory in the Glasgow Technical College, and arranging to utilize it for the training of students.

In speaking of education, the great educative value of our technical journals cannot be left out. The gas profession is fortunate in its technical papers, which give week after week reports of papers and descriptions of new methods which increase our knowledge and keep us up to date. Some years ago, when taking correspondence classes, I found the technical journals of more value for reference than any text-book. The moral is obvious. It is not easy for the Juniors by themselves to remedy matters. Our Association can help by giving advice and assistance to young members in arranging their studies. Otherwise the task is really one for the Senior Associations; and we can only take every available opportunity of bringing before them our sincere desire for improvement, and our wish to assist.

I have spoken of these matters because I have felt the need, and because, in a fairly lengthy official connection with this Association, I have come to share the aspirations of the members and to sympathize with them, and desire to help them in their strivings towards a fuller and deeper knowledge of the things which make up our profession.

EXAMINATIONS.

Coming, now, to my second head, we are on very debatable ground; and I do not expect that my views will meet with anything like unanimity. But examinations are a natural corollary of any scheme of education, and those who have taken advantage of their opportunities welcome the possibility of putting their acquired powers to the test. Mr. James MacLeod, of Greenock, one of our Past-Presidents, in a recent article, said that the Institution of Gas Engineers had failed in its duty in not formulating a proper scheme for the certification of gas managers.[*] I am in agreement with him that such a scheme would be to the benefit of the profession. At present the gas profession stands almost alone in that it does not give those having appointments to make a lead by testing and certifying the qualifications of men seeking to fill the position of managers.

There is, of course, the City and Guilds examinations approved by the Gas Institution; and I must admit that in recent years the certificate has not been so easy to get. The examination is, however, very incomplete; for, being only a written examination, it can be passed by the bookman with a good memory, even though his practical experience is negligible. It is not a sufficient test of a man's knowledge. That this is recognized is proved by the utterances from time to time of leaders in the profession. A thorough examination should be both written and oral, and should require a certain standard of knowledge in each of the subjects which form the composite examinations—"Gas Engineering" and "Gas Supply."

Let us consider the case of the mine manager, who must pass the Board of Trade examination before he is able to take up a position as mine manager. There are two certificates of competency—first and second class; and candidates sitting for the examination must be at least 23 years of age, and have practical experience in mining for not less than five years, or, if in possession of an approved diploma or degree, of not less than three years.

A candidate for a first-class certificate must possess such a knowledge of arithmetic, mathematics, physics (including electricity), chemistry, geology, and engineering science as will enable him to properly answer questions in the syllabus. The syllabus comprises: (1) Winning and working; (2) theory and practice of ventilation; (3) explosions in mines, underground fires and inundations, their causes and prevention; (4) machinery; (5) surveying, levelling, and drawing; (6) general management and mining legislation, all with their various sub-heads. For a second-class certificate the syllabus is very similar; but the questions are of a nature suitable for practical working miners.

The examination is in two parts, written and *vivâ voce*. In the latter, candidates are required to display a detailed knowledge of practical methods of mining in the division in which they are being examined. For a first or second class certificate, candidates must qualify in each of the subjects, and must obtain 40 per cent. of the maximum marks obtainable for each paper, 40 per cent. of the maximum marks for the oral examination, and 60 per cent. on the whole examination, to qualify.

It is an examination conducted on these lines by the Institution of Gas Engineers that is wanted. Such a certificate would hallmark a man's abilities, and have a corresponding value. The energies of the Institution would profitably be directed to so influencing opinion that no man could obtain a position as gas manager without gaining his certificate of competency. The result would surely be of great advantage to the status of the profession; for it would be protected against the possible inclusion of those having no real pretensions to holding the position of gas manager. I think, also, it could not fail to result in an increase in the emoluments offered; for the knowledge that a standard of qualification is set could not fail to influence the public mind in this direction. The ordinary man is very apt to think there is nothing in making gas; and we should attempt to eradicate this erroneous opinion.

There is also another point on which I think the certificate of competency would operate advantageously to the gas manager. It would help to protect him against unfair treatment by a council or board; for the Institution could hardly fail to recognize the necessity of protecting those to whom it had given its diploma. In fact, I do not think you can ever properly seek to protect the gas manager until you have certified his competency.

In concluding these remarks on examinations, I cannot do better than quote words used by Lord Palmerston in a speech on examinations: "A young man having selected a particular profession should devote the utmost vigour of his mind to qualify himself for it by acquiring the knowledge which is necessary for distinction in that line of life." That is the spirit which I hope and think actuates the minds of the members of this Association; and I am sure that the progress of our profession will find a corresponding progress in your intellectual faculties, and that whatever calls may eventually be made upon you, you will not be found wanting.

GAS-FIRES.

The following points are frankly introduced in order to evoke discussion.

Recent years have witnessed great improvements in the construction of gas-fires; and their efficiency and convenience have resulted in a very large increase in their use. But the addition of improvements in construction and efficiency year after year presents the gas manager with the problem of how best to supply them to the consumer in a manner advantageous to the user and to the gas undertaking. In Helensburgh, we let fires on hire at low rates; but my experience has not inclined me favourably to this method. There is the constant expense of changing fires; for whenever your consumer sees or hears of something new, he will have it. To-day a gas-fire need not be very old to be out of date; and it takes a courageous man, certainly not a thrifty Scot, to view with equanimity the scrapping of these fires. The problem of the fire which has been out and is returned is a little difficult, for letting them out on lower terms is not of any great service. There is also the consumer who fits gas-fires in the spare rooms which are only very occasionally used. One thinks of the initial cost of fire and fitting, and can only hope that when the fires are used they will so prove their convenience and utility that others will be speedily installed in the rooms which are used.

There is also another point which must receive consideration in deciding the policy which will guide the supplying of gas-fires. The consumption of gas by gas-fires being greatest when the ordinary load is greatest, large increase in their use naturally tends to reduce the reserve of carbonizing and other manufacturing plant; and an undertaking will eventually be involved in additional capital expenditure in providing extra plant. Altogether I am of opinion that gas-fires should be supplied to consumers on such terms as will make them pay for themselves, and not burden the gas rate. My own inclinations favour a hire-purchase system which will recover the cost in a period of at most three years.

SERVICE PIPES.

In a residential town like Helensburgh, a large number of the houses are placed at a very considerable distance from the line of street main; and accordingly service-pipes are costly to lay. There is an amount of inequity in laying these services free; for the man whose service-pipe is 150 yards long has a considerable advantage over the man whose service is only 10 yards long. Therefore it is our policy to charge time and material for all service-pipes laid inside the line of feu to the inlet of the meter. Previously we were content to recover cost. About two years ago, however, we had trouble on the matter with the local tradesmen, who complained of unfair competition; and since then we have been charging trade rates. This policy suits us quite well, though I am afraid that where there is competition with electricity a different policy would be necessary.

GAS HOT-WATER HEATERS.

There are now many excellent gas hot-water heaters on the market; and this summer we introduced them to our consumers on hire-purchase terms, with, for a beginning, pleasing success. There is, however, great need for a cheaper form of copper circulator; for the present rather high price militates against their general adoption. The cheaper circulators are made of cast iron; but these are unsuitable for our hot-water systems, where storage tanks and circulating pipes are of copper. There appears to be a form of electrolytic reaction between the iron and copper, which deleteriously affects the former.

DISCUSSION.

Mr. Jas. S. M‘Nicol (Dawsholm) opened the discussion. He said there was no doubt but that there should be some clearly-defined path laid out which the student could start and follow up, and gain the position he desired—that of gas manager. At present they were allowed to muddle on, finding out when it was too late that they had started at the wrong end of the business. With reference to a library, there was no doubt they could do with one for the Association. Articles in the Technical Press were certainly of very great advantage to the student; but the drawback was that he could not get access to the gas journals and the "Transactions" of the Institution of Gas Engineers for past years. It would be a glorious opportunity for some of the Seniors who had gas journals and proceedings that they seldom or never looked at to present them to the Juniors. Mr. Fulton had remarked, in reference to the City and Guilds examinations, that Mr. Glover said the student came forward unprepared. This was true. But the examiners were sometimes to blame, as they put questions in a way that could not be understood.

Mr. James M‘Ghee (Glasgow) found himself in general agreement with Mr. Fulton on most points. The deficiency of being unprepared to which he had referred, and to which Mr. Glover had alluded, in many of the students, was reflected all along the line, even in the gas-fitting classes. With the experience he had had of checking papers and of examining, he was astounded at the lack of general information and of ability in some of the candidates to put their thoughts into English. Many of them in the local examinations failed to do themselves justice. In connection with one or two who did remarkably well in the gas-fitting classes, he found it might be attributed to the fact that these men were taking an interest in outside societies apart from their own trade.

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[*] See "Journal," June 1, 1915, p. 502.

Yet several of these men, as actual workmen, could not hold a candle to others who had let themselves down very badly. He put down much of the general deficiency to the lack of a properly-defined path. He considered it the duty of the seniors to help, and he trusted they might not think it presumptuous for the uniors to point out the way they should go. They did not appreciate the keenness existing nowadays to attain to the coveted positions. Many, however, did appreciate it, and showed, by their personal help, how they wished the young men to go forward. He considered it was a duty to lay down a definite curriculum. He had been in mining classes, and he remembered being asounded at the amount of work expected from the manager of a coal mine. He had formerly thought, with other people, that any one could fill the job. Assuming that a curriculum were laid down, he would say there was no necessity for it being under the egis of the City and Guilds. There was the Herriot-Watt College in Edinburgh, and the Technical College in Glasgow. Certificates from them would be sufficient. He failed to see why a certificate from these colleges should not carry as much weight as one from the City and Guilds of London. He would say it was he duty of the North British Association to emphasize this point. Dealing with the allied courses, more stress might be laid on the ommercial side of the subject. A great many men had had to ain this knowledge by hard experience. Earlier in their days, f they had had the knowledge which Mr. Fulton had dwelt on, they would have saved their companies many consulting fees. There had been instituted this year, for the first time, a pracical class in connection with gas-fitters. Cylinders, tanks, and arious types of hot-water circulating appliances were being intalled. The students would be given these to fit up. These were being furnished along with many other appliances—gas-engines, high-pressure lamps were to be included in this practical course. They hoped that they would be able to draw upon the apprentice plumbers, and that they would be able to take the certificate in he fitting class.

The Hon. Secretary said that Mr. Fulton had voiced a matter which was engaging not only the gas industry, but practically very industry of the country. The gas industry occupied a eculiar position in the fact that it was not a large industry, comared with engineering and other allied industries. In contrast with Mr. Fulton, he held it was in the early years that a young man had no desire to learn anything. Most of the youths who went to technical classes were sent by their employers, who were ar-sighted enough to think that a good training given to them meant money in their pockets later on. The boys went there, nd unless one got a grip of them one would not get them to earn anything. He had once been asked to take a class of mining engineers. In the class there were 15 students, and only three of whom were younger men than himself. They had men in the class up to 45 years of age studying for the mine manager's certicate. If a man of 45 studied for this certificate, surely a man in the gas industry could likewise study. Who was to direct the tudent? The parents, unless they were in the gas industry, could not do so. The direction of the student must be wholly with he chief. As regards unpreparedness for the City and Guilds, it was quite understandable. To anyone who had experience of the eaching classes, it was remarkable the teachers they got. The emuneration now paid to teachers was not sufficient to draw the ight men. The gas industry was small, and could not pay good ums to teachers. They had men teaching engineering who really were not engineers but ordinary teachers, and they used books which were not written by engineers. If they ever did get men who were connected with the gas profession, they were there ecause they could not make enough in the gas industry. It was lways found that if one got a good man into the business, he made far more at his profession than he did at teaching. It was ven claimed that the teaching was used more as an advertisement than anything else. It was undoubtedly the case that a cheme of apprenticeship should be laid down; but it would have o be interpreted upon a very wide basis. If boys went to evening classes, they must be allowed time to attend class and preare for it. It was ridiculous to expect a youth while working to pend the whole of the winter studying and tearing his life and oul out to make himself better. In Germany, they did not believe much in examinations, especially written ones; they believed more in oral examinations. Personally he did not much believe in xaminations at all. The whole point, however, was: Do gas managers want trained assistants? In other branches of industry, he leaders of industry did not want trained assistants. They were afraid of them.

Mr. A. H. Whitelaw (Glasgow) disagreed with Mr. Fulton's emark that to-day a gas-fire need not be very old to be out of ate. He thought it would be a serious thing if this were so. He mentioned fires which had been on the market for ten or fifteen ears which were as good to-day as when they were introduced. Coming to the frame fires, all the makers had brought them to a ery high pitch of perfection. The burner was giving maximum fficiency. If fuel could be improved, so much the better; but it hould always fit the same burner. The matter of ventilation had lso been advanced. It would be a sad thing if the fires they had in the district just now had to be taken in because it was thought here was a better article on the market. He believed they were upplying the fires too cheaply. The people should put in the ipes themselves. Cookers were standardized; and the time had ome when fires also should be standardized. As for gas water-eaters, one might have ten years of the classes Mr. Fulton had been referring to and know very little about the subject. It was a difficult subject, and one regarding which there was a great deal to learn. The makers promised 95 per cent. efficiency for a hot-water heater. He had carried out tests on most heaters on the market; and he thought one was very lucky to obtain 60 per cent. efficiency at the tap.

Mr. J. MacLeod (Greenock) said the isolated position of many gas undertakings rendered the problems raised by the President very difficult. Some form of examination was necessary to raise the status of the profession. He thought Mr. Fulton was quite right in saying that the right status that the gas engineer should have could only be attained when there was a general examination. It was to the younger men that they looked for advance. He had recently the opportunity of seeing the syllabus of the Birmingham Technical College. It was an excellent one, extending over five years for the training of the gas engineer. It could be adapted by the Glasgow Technical College without any difficulty. If any young man went right through this syllabus he would be trained very well indeed—at least, to the extent a man could be trained. Of course, no system of technical education could wholly train a man for his profession. Men were born with special aptitudes. But some form of systematized training was absolutely essential. He hoped that the Technical College would form a course, and that the College certificate, would be of high value to young gas engineers. He trusted when some of their young gas engineers had got placed, they would display extra energy to improve the status. Unfortunately, the Gas Institution was not improving the status of gas engineers, and improvement rested with the younger men. Mr. Fulton, he thought, was right regarding gas-fires. He would go further. It should be a limited purchase system. In the course of two or three years the fire should become the property of the consumer. He could not agree with Mr. Whitelaw that the fires did not get out of date, nor could one convince the ladies that they did not get out of date.

Mr. Thos. Frazer (Dalmarnock) supported the contentions of Mr. Fulton regarding the training of the student. He knew of cases where they got the credit of having more knowledge than they actually had, and where they were so ashamed of themselves that they would not go among the young men to learn what they ought to know. Wherever there was any public money at stake, the man who was to rule the affairs of the company or corporation ought to have a certificate of merit of some kind to show that he had qualifications. The Association to which he might belong would then be in a position to protect him.

Mr. Alex. Wilson (Glasgow) said he would see what could be done regarding Mr. M'Nicol's suggestion as to a library. As one who had taken a good deal of interest in the classes in the Technical College, he knew that Dr. Grey was most anxious to adapt his classes to the needs of those of them who wished to qualify for the gas profession. At one time Dr. Grey was of the opinion that the College ought to give a certificate to those who had passed the examinations in the classes there. But he (Mr. Wilson) pointed out that this would only carry a certain weight. As they knew, the Institution of Gas Engineers were working in harmony with the City and Guilds—in this way, that it was actually their recommendation that placed the gentlemen who set the papers and who examined them. In this way the examiners were not exactly under the City and Guilds, who carried out the details. When a man obtained a certificate, he was really getting the certificate of the Institution of Gas Engineers. The Institution saw that proper men were named as examiners. This put a hall mark, and an equal hall mark, for students all over the country in a way that could not be done if every college gave its own certificate. For instance, it would be difficult to say if the man who passed in Glasgow was equal to the one who passed in Manchester. By the present process, a man knew he was up to the general standard for the whole country. He thought the foundation of the gas engineer was the mechanical engineer. Gas-works were just a big machine shop nowadays. A man wanted to get a practical training in engineering, but also a theoretical training in engineering. He wanted a practical training in chemistry, but also a theoretical training in chemistry. These sciences were the foundation of a thoroughly educated gas engineer. Added to this, he wanted a commercial training. Talking of the course laid down, he took it that Mr. Fulton almost hinted at a college course of gas engineer training. Not many of them could afford this. Regarding gas-fires, they took up the position in Glasgow that people must pay for them. They were quite different from stoves. Stoves in the summer time gave such a profit that they paid their way. They were standardized because they came to such perfection that it was not likely they would be altered. Fires were quite different. They were improving, and had, he thought, not got to the pitch of perfection yet. They should allow the makers to go ahead until they obtained a perfect gas-fire.

Mr. John Wilson (Falkirk), in concluding the discussion, said it was all very well for a man to say he wanted to be a gas engineer; but he needed a little assistance from his seniors in placing him on the right road. It was wonderful how far one could go off the road even when one was well meaning. He did not see why the Institution of Gas Engineers should not be able to set out in the form of a syllabus the classes best adapted for the student going in for gas engineering. If they appointed the examiners for the City and Guilds, why not call it the Gas Engineers' certificate?

Mr. Fulton, who was highly praised for his address by all the speakers, suitably replied.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Dublin Gas Company and its Affairs.

Sir,—I have to-day received the enclosed from one of the Directors of the Alliance and Dublin Gas Company.

Read in conjuction with my last letter to the "Journal," criticizing the affairs of the Dublin undertaking, it speaks for itself.

R. W. Edwards ["Nonulus"].

Aldershot, Oct. 23, 1915.

[Enclosure]

Blackburn, Oct. 22, 1915.

Dear Mr. Edwards,—Would you kindly oblige me with a copy of the Aldershot Gas Company's balance-sheets for the half years ending June, 1912, and June, 1915. Best regards.—Yours faithfully,

W. H. Davies (of the Dublin Gas Company).

Sulphate and Potato Crops.

Sir,—I notice in your report of the discussion on Mr. Leighton's paper, on Sulphate of Ammonia, at the meeting of the Midland Association, that I am made to say that a farmer in this district obtained a crop of potatoes three times the quantity where sulphate of ammonia was applied over farmyard manure. I said one-third more, and am pleased to say now the crop is finished that it turns out 40 per cent., and a better quality, where the sulphate of ammonia was applied.

Alfred Bird.

Bromsgrove, Oct. 21, 1915.

The Wandsworth Gas Company and its Coal Supply.

Sir,—I find that some observations I made to the meeting of the Wandsworth Gas Company, as to the general difficulties which had arisen in the transport of coal, have been misunderstood as applying to the loading by those collieries specially supplying the Company.

Addressing shareholders who knew that the Company possessed its own ships, and therefore controlled the bulk of its transport, I perhaps did not make it clear that I was explaining the Company's action in supporting the general movement of gas companies and others for getting Government assistance as to shipping and as to the restriction of exports.

I am glad to say that the collieries specially contracting with the Company loaded its vessels satisfactorily; indeed, one colliery which undertook a portion of the shipping—viz., the Pelton—fully discharged their obligations in that difficult respect also.

Hy. E Jones.

Palace Chambers, Westminster, Oct. 20, 1915.

Lincoln Gas Undertaking.

Accounts which have just been completed relative to the principal trading concerns of the Lincoln Corporation, embody some fairly substantial figures. In the annual period dealt with up to March 31 last, 259,950,375 cubic feet of gas were supplied to private consumers, yielding £25,995, while £961 was received from private consumers, who used 10,986,523 cubic feet. The total quantity of gas sold within the city and to the Bracebridge Urban District Council and the Parish Councils of Bracebridge and Boultham was 336,467,036 cubic feet; and the balance of gross profit carried to the net revenue account, £12,603. Mr. W. H. Mainwaring (the Gas Manager), in his report accompanying the Committee's statement, pointed out that, in common with similar undertakings throughout the country, Lincoln has suffered through increased prices of raw material and dislocation caused by the war. During the autumn of 1914, there was a reduction in the ordinary gas consumption of approximately 7,000,000 cubic feet, as compared with the corresponding period of the previous year. The order restricting lighting also affected the output to the extent of upwards of a further 6,000,000 feet. Allowing for increased consumption earlier in the year, there was a decreased make of 10,000,000 cubic feet on the year. The outlook for the twelve months commencing April was most unpromising, as the cost of coal would evidently be increased to an unprecedented extent. There are about 1600 incandescent gas-lamps in the streets of Lincoln; and for these 66 gross of mantles were used during the past year. This gives an average of six mantles per lamp, which is the same as the requirements of the preceding twelve months.

Price of Gas at Saffron Walden.—Reporting at last week's meeting of the Saffron Walden Town Council, the Gas Committee notified that they had resolved to accept the instructions of the Council and reduce the price of gas from 3s. 2d. to 2s. 11d. per 1000 cubic feet, and for slot-meters to 1d. for 23 cubic feet, as from the 1st inst.

Industries of Leeds.—In various ways, the "Yorkshire Observer" says, Leeds industries are preparing for the industrial war which will certainly rage in full fury when arms have been laid down. Engineers who have many valuable ideas simmering for exploitation later on are meantime too busy on war work to devote attention to future progress; but here and there in other branches of industry a steady advance is being made in capturing markets hitherto practically monopolized by the enemy. The manufacture of gas-mantles, for example, has reached a high-water mark which would have seemed unattainable eighteen months ago. At that time the struggle was to "get in" in the face of an almost overwhelming competition; now it requires equally strenuous work to cope with the huge influx of orders caused by the withdrawal of the competition. That the German rivals have not been disposed of for good is quite well understood. But painstaking researches into the chemistry of ramie grass have enabled more skilful processes of manufacture to be adopted; and the future is looked forward to, if not with equanimity, at any rate with calm confidence.

REGISTER OF PATENTS.

Separating Volatile Products from Solid Carbonaceous Material.

Oil and Carbon Products, Limited, of Adelphi, W.C.

No. 13,868; June 26, 1914. Convention date, Jan. 7, 1914.

This invention relates to apparatus for the separation of volatile products from solid carbonaceous material—coal, shale, peat, &c.—by heating in a retort and conveying the evolved vapours to a cooler region. In prior systems of separation, the patentees remark, this cooler region has usually been constituted by separate condensing apparatus.

The present process of separation consists in maintaining a number of regions occupied by the material within the retort at temperatures increasing from the inlet end by the indirect application of heat, moving the material through the retort under non-oxidizing conditions, and so regulating the temperatures and directing and controlling the withdrawal of the condensable volatile products that their different grades are evolved from all portions of the material at their respective vaporizing temperatures, and thereupon conveyed into contact with relatively cooler portions of the material in its solid or partly vaporized state, whereby condensed volatile matter is obtained which can be removed from the retort in liquid form.

The conveying of the material through the retort—which is preferably cylindrical and slightly inclined upwards towards the hot end—may be most conveniently effected by means of a helical blade working on a rotary shaft; and the uniformly graduated temperature of the material is maintained externally by providing an annular space around the retort and arranging in the space one or more axial rows of gas and air jets of graduated size. A graduated heating may also be applied to the material from inside the retort in such a way as to heat the core of the material as well as its outer part. For this purpose the conveyor may be adapted to act also as a conductor and radiator of heat, as described in patent No. 15,381 of 1914. Consequently the material under treatment at any cross-section of the retort is heated uniformly owing to the application of heat not only from the cylindrical wall but also from the conveyor.

The gaseous medium, which may be the washed and purified uncondensable gaseous product from the retort, is introduced in a cold condition, and so serves to cool the coke as it passes out of the retort. It is made to travel through the retort at a comparatively slow speed, and therefore assumes the successively decreasing temperatures of the successive regions through which it passes. It may also be pointed out, the inventors remark, that since the material under treatment travels into regions of progressively increasing temperature, instead of entering immediately into a region of maximum temperature, the volatile constituents of the material are gradually "sweated out" and cannot be overheated or "cracked," because as soon as they arrive at the region corresponding to their vaporizing temperature they are immediately taken up by the gaseous medium and conveyed to a cooler region into contact with relatively cool material, whereby their condensation is for the most part effected. Moreover, even if the hot end of the retort is raised to a temperature considerably exceeding the vaporizing temperature of the least easily volatilized constituent, no overheating of the vapour takes place, because all the grades of vapour are carried off by the gaseous medium at the regions corresponding to their respective vaporizing temperatures. In the hotter regions beyond the region at which the least easily volatilized constituent is carried off, the coke or other vapour-freed material is merely heated further, but yields no more volatile constituents condensable at approximately atmospheric temperatures, since all the latter have already been removed at their respective vaporizing temperatures in cooler regions within the retort, as already stated.

Fig. 1 (p. 207) is a side elevation of a set of five retorts and accessories—the lowermost retort being shown in section. Fig. 2 is an end elevation, and fig. 3 a plan. Fig. 4 is an enlarged cross section of the retort.

The cylindrical retorts A, arranged one above the other, are each enclosed in fire-clay slabs B shaped to provide an annular space C, which may be filled with loose broken brick or fire-clay. Through each retort extends a shaft D, to which is secured a sleeve, formed with a helical blade—both removably secured to the shaft so as to rotate with it. The retorts are slightly inclined, and their lower ends are secured to inlet boxes into which the material to be treated falls from a hopper E by way of a rotary valve F. The helical blades extend into the inlet boxes, and their shafts project through the boxes and are provided with ratchet wheels for engaging with pawls mounted on rocking arms G, operated in one direction by a hydraulic ram and in the other direction by the unbalanced portion of the combined weights of the arms, which are partially balanced by a weight. Each of the boxes contain a part-cylindrical scoop situated beneath the adjacent part of the corresponding helical blade without, however, entirely obstructing the vertical passage through the box; so that the material escaping over and around the blade and scoop in one box descends into the box below it.

The upper end of each retort is secured to an outlet box, into which the spent or vapour-freed material is thrust by the blades, whereupon it falls down, and is delivered through a rotary valve H to a truck in a sunk track or passage-way.

In the lowermost part of the space around each retort extend longitudinally two pipes J, one for air, the other for gas. The pipes are radially perforated at intervals in their length, and are angularly adjustable to enable the gas and air jets to be directed at any desired angle against one another. The holes are graduated in size—the largest being at the gas inlet end. The gaseous medium is introduced in a cold condition and at a pressure of about 4 lbs. to the square inch into the top of the exit valve H.

In operation, the material to be treated enters the retorts at atmospheric temperature through the inlet boxes, and is slowly conveyed by the blades through the retorts from left to right; while the cold seous medium enters the retorts through the outlet boxes and travels om right to left. The material under treatment encounters regions progressively increasing temperature, and the gaseous medium con- ys the vapours evolved at any region into regions of lower tem- rature, as already described—the result being that the spent or pour-freed material passes out of the retorts on the right hand rough the valve H comparatively cold, while the condensation of e evolved vapours occurs near the left-hand end of the retorts by ntact with the cold incoming material. The condensed vapours flow wn the retorts and through the inlet boxes, and are withdrawn low the lowermost box by way of the receptacle K. The liquid may en be subjected to fractional distillation in the ordinary way. The seous medium and the uncondensable vapours pass out of the retorts rough exits, and are afterwards washed and purified in a similar anner to that adopted with the retort gases of ordinary coal-gas anufacture. The quantity and character of the uncondensed vapours ssing through these exits are dependent in part upon the tempera- re at which the lower end of the retort is maintained. Some of the sultant gas is used again as the gaseous medium of the process, and e remainder stored.

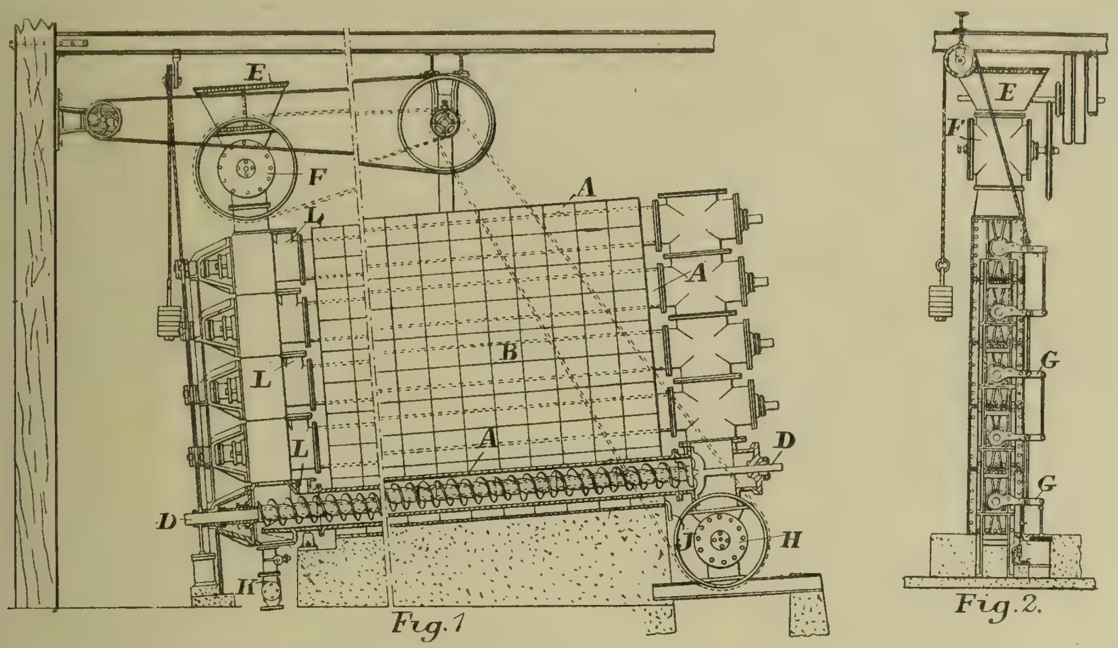


Fig. 1

Fig. 2.

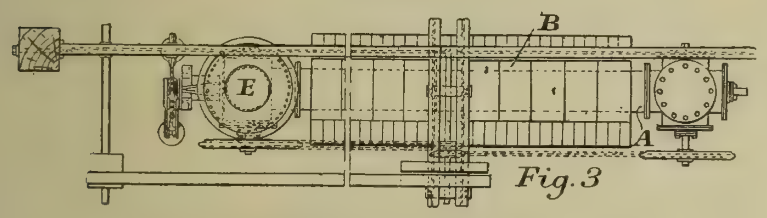


Fig. 3

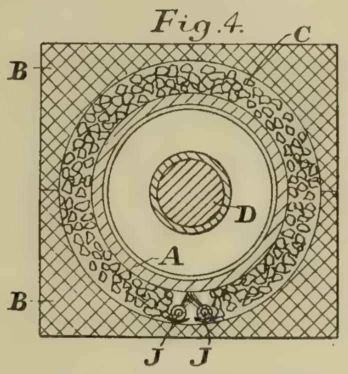


Fig. 4.

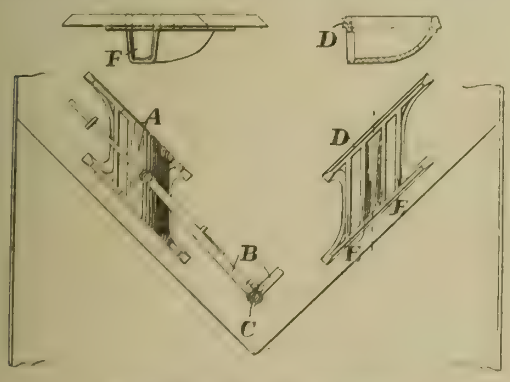
The "Oil and Carbon Products" Company's Plant.

Gas-Meters.

Hibberd, C. E., and Goad, F. L., of Edinburgh.

No. 20,922; Oct. 13, 1914.

This invention relates to meters having reciprocating valves for dis- buting the gas in the sheet-metal casing divided into two compart- ents by a horizontal partition—the lower compartment being further vided into two measuring chambers by a vertical partition.



Hibberd and Goad's Gas-Meter.

The illustration shows a plan and a cross-section of the valve grating nployed, and a plan of the valve plate.

The meter to which the patentees prefer to apply their invention is the type in which a pair of measuring chambers of the double pie- sh form are arranged back to back—one on each side of the longi- dinal centre plane of the meter—so that the flanged joints of the easuring chambers, their back and front walls, and the general planes the diaphragm clamping plates are all parallel to the centre plane. he valves A thus receive their motion, by connecting rods B, from a ommon crank C forming part of a vertical shaft or spindle, which is rotated in the usual manner by flag and flag-rod mechanism; while the lines of motion of the valve are symmetrically arranged in respect to the centre plane of the meter and are inclined about 45° to it.

According to one form of the invention, each valve grating consists, as before, of two lateral bars D (parallel to the lines of travel of the valve), connected by four cross-bars or bridges E, so as to leave three intermediate ports. But, instead of the cross-bars being at right angles to the lateral bars, they are arranged at an angle and parallel to the centre plane of the meter. The ports are of the usual elongated form —their shape being that of a rhomboid, instead of a rectangular parallelogram, while the general shape of the grating conforms more or less to that of the ports.

Each valve, which is preferably of D type, is modified in a similar manner as regards its general shape and the obliquity of its ports, so as to co-operate with the grating described—the one valve being right-handed and the other valve left-handed. The exhaust duct F is formed integral with the valve grating, instead of being built-up in the usual manner.

By arranging the valve grating as described, the connection between the exhaust port and the outlet tube of the meter is simplified, while the length of the solder joints is reduced, and the soldering operation facilitated.

Regulating the Supply of Gas to Burners.

Pickard, W., of Rochdale, and Bentley, J. E., of Blackpool.

No. 22,847; Nov. 21, 1914.

This invention relates to regulating means of the kind in which is a floating needle valve, arranged within a chamber, controlling the gas by closing or opening the passage through which the gas flows to the burner; the movement being adjusted to suit either high or low pressure gas.

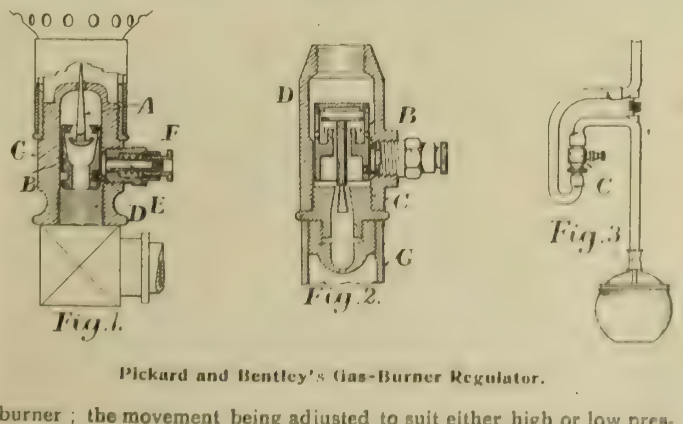


Fig. 1.

Fig. 2.

Fig. 3

Pickard and Bentley's Gas-Burner Regulator.

Fig. 1 is a vertical sectional elevation of the device as applied to an upright burner. Fig. 2 is a like view as applied to an inverted burner.

Fig. 3 shows the application of the regulator in the length of the supply pipe of a pendant gas-fitting.

The regulating appliances comprise the valve A within a tubular casing B slidably fitting the outer fixed body C of the burner fitting. The valve is of the needle type, with a mushroom shaped head ; the needle part being designed to extend upwards and through an opening in the top of the casing B, and also through an opening in the upper end of the casing C. The interior of the casing B is formed as an inverted cone, instead of being narrow at the top and wide at the bottom —the advantage of thus forming the chamber being, it is said, that the gas, after first lifting the valve, tends to act upon the top side of the head part of the valve and thus prevent any sudden closing of the upper opening under any slight increase in pressure.

To regulate the position of the valve in relation to this opening, and according to the pressure of the gas, the casing B at its lower end is formed with an annular groove into which projects the pin of a disc D, eccentric to the centre of the disc. The disc is carried by a spindle E rotatably and slidably mounted in a lateral boss screwed on to the casing C. By means of a spring F, the disc is frictionally held against the end of the boss, and thus remains in any position to which it is rotated. By rotating the disc D, the pin raises or lowers the casing B, and thus varies the position of the valve seating in the casing relatively to the opening in the casing C.

In fig. 2, a space is left between the exterior of the casing B and the interior of the casing C, while the top of the casing is entirely enclosed by a cap. In the wall of the casing B, and below the level of the valve head (which latter is preferably of disc formation), are holes. The stem of the valve passes down and through a tubular part of the casing B, and also through the opening of the outer casing C—this latter, for the purpose of admitting the casing B, being in two parts. The lower part of the valve stem is formed conical and with the narrower part uppermost, so that, with the raising of the valve head off its seating under the pressure of the gas—the latter entering via the holes and passing down and through the opening - the conical part of the stem operates to regulate the supply of gas to the burner.

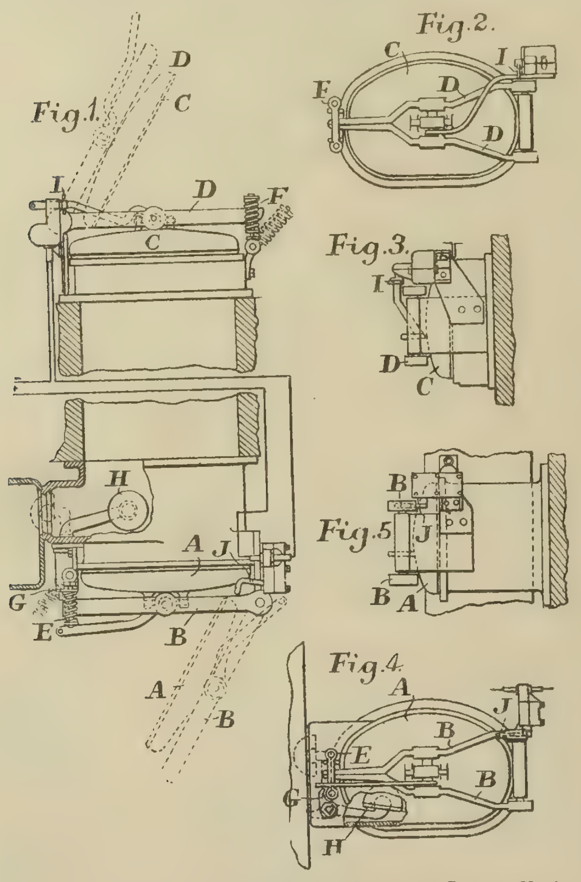
As shown in fig. 3, the fitting (fig. 1) may be used as a union in the length of a flexible pendant fitting.

Closure Locking Means for Gas-Retorts.

CARPENTER, H. A., and WARNER, A. W., of Sewickley, Penn., U.S.A., and the RITER-CONLEY MANUFACTURING COMPANY, of Pittsburgh.

No. 20,199 ; Sept. 25, 1914.

This invention relates to the provision of gas-retorts at each end with doors which are normally closed, but which are opened during the charging, discharging, or other operation of the retort ; and the object aimed at is to provide for the control of the doors "in such a manner as to prevent premature opening of a closure, whereby accidents or delays in the operation of the apparatus, such as sometimes happen, due to premature opening of a closure, are avoided."



Carpenter and Warner's (Riter-Conley Company) Retort-Closing Mechanism.

Fig. 1 is a sectional plan of the charging and discharging ends of a gas-retort and the closures therefor—the latter being shown closed in full lines and open in dotted lines. Fig. 2 is a front elevation of the closure at the discharge end. Fig. 3 is a side view of it. Fig. 4 is a front elevation of the closure at the charging end. Fig. 5 is a side or edge view thereof.

As illustrating an embodiment of the invention, A is the closure for the charging end of the retort, and B its hinged bar-like support ; while at the discharge end C is the closure, which is carried by the hinged bar D. The free end of the bar B is confined by a laterally swinging latch mechanism E, and similar mechanism F performs the same function for the bar of the discharge closure. Horizontally swinging arms control the manipulation of the bars necessary for releasing the latch mechanism.

For so connecting the charging and discharging closures that the latter cannot be opened in advance of the former, mechanism is interposed which at the charging end is operated by the movement of the hinged closure support B, and at the discharge end co-operates with the swinging arm, which is held locked (as indicated in full lines) until the front closure has been opened. While there is no impediment to the movement of the arm of the charging closure from the position shown in fig. 4 and in full lines in fig. 1 to the open dotted position of fig. 1, the support B cannot be released from its latch E until the index arm G is moved out of the way of the latter, which can only be accomplished by closing the valve H so that it is mechanically impossible to swing the support to the open position before closing the off-take valve.

The mechanism for connecting the front and rear closures for ensuring their opening in proper sequence may be variously arranged. As embodied, the mechanism includes an electric motor device for actuating the discharge closure lock, together with a switch for the circuit of the device, which is opened by the closing movement of the inlet or charging closure, and closed by the opening movement of it.

The lock device for the arm of the discharge closure consists of an arm which is forked at I to embrace the arm when it is in closed position, as shown in full lines in fig. 1 ; the arm being secured to a rock-shaft journaled in a casing secured to the mouthpiece, and secured to the shaft within the casing is an arm which, when raised, keeps the lid from swinging outward into the releasing position.

When the support B and closure A are in their position shown in fig. 1, an arm J is pressed inward, and the circuit breaker employed is held in the open position notwithstanding the pressure of a spring. But as soon as the support swings into the open position, the spring moves the arm into engagement with the necessary contact and closes the circuit. This results in energizing a solenoid, and the upward movement of its core tilts a bell-crank latch and releases the lock for the arm of the discharge end closure, whereupon the latter may freely open. But prior thereto the closure C is held securely locked, and it is quite impossible to open it in advance of opening the front end or charging closure A. And as the latter cannot be opened until communication is closed between the retort and off-take, "the sequence of operations is relieved of the uncertainties of human control—the several elements being so connected as to insure their operation in proper sequence."

APPLICATIONS FOR LETTERS PATENT.

14,339.—LAW, J. R. K., "Extinguishing gas-lamps." Oct. 11.

14,390.—ROLLASON, F. A., "Carbonization of coal in vertical or inclined retorts." Oct. 12.

14,391.—TWYNAM, T., "Utilization of Mond gas, and recovery of bye-products." Oct. 12.

14,481.—GRAHAM, J. T., "Air-gas plant." Oct. 13.

14,565.—DRAKES LIMITED, and DRAKE, J. W., "Removing coke." Oct. 15.

14,624.—HALL, I., "Burners for producer gas." Oct. 16.

14,635-6.—LAW, J. R. K., "Automatically controlling the supply of gas to lamps." Oct. 16.

Grays and Tilbury Gas Shares.—Messrs. A. & W. Richards, of No. 37, Walbrook, E.C., are, on behalf of the Grays and Tilbury Gas Company, issuing by tender 600 £10 "B" shares. These will rank for a standard dividend of 7 per cent., equally with the Company's existing similar shares, now receiving £5 19s. per cent. The minimum price is £10 per share.

Brigg Gas Charges.—At a meeting of the Brigg Urban District Council on Friday, a statement was presented showing a small estimated deficiency at the end of the year upon the gas receipts. It was decided to make no alteration in the charge to slot-meter customers, but that if any change-over was made by ordinary consumers they should be required to pay 7s. 6d., and keep to the slot-meter for three years. For gas used otherwise, it was agreed to increase the price by 7½ per cent.

United Tube Corporation.—The United Tube Corporation, Limited, has been registered at Somerset House, with a nominal capital of £150,000 in £100 shares. The Board of Trade authorize the acquisition of a part of the undertaking of the British Mannesmann Tube Company, Limited, the books and documents of which are liable to inspection under the Trading with the Enemy Act, 1914. The Company is a private one, and the first Directors are Colonel J. R. Wright, Mr. S. Baldwin, M.P., Mr. J. C. Davies, Mr. G. Hethey, Mr. H. W. Dunn, and Mr. A. Hethey, with a qualification of £1000.

Need for Gas Incinerators.—In a paragraph on the displacement by gas of the kitchen coal-range, the "Sanitary Record" says : The ordinary coal-fire is disappearing from our homes ; and in course of time, owing in great measure to the remarkable improvements which are being effected in the manufacture of gas-fires, the latter will be found to be so much cheaper in maintenance than coal-fires that the latter will be deemed to be extravagant and—as they undoubtedly often are—wasteful. We are met, however, by those who use gas-fires with the contention that the disposal of garbage and household refuse constitutes a serious difficulty. This can only be overcome by the invention of a gas incinerator or garbage destructor. Probably the most acceptable solution would be found in a gas-fired garbage destructor so constructed that the heat would be utilized for providing hot water for the household and for baths. The enterprise and inventive capacity of gas engineers are so conspicuous that we venture to believe they will succeed in meeting what is really a necessity.

LEGAL INTELLIGENCE.

CLAIM FOR GOODS SOLD AND DELIVERED.

Yesterday (Monday) the action of Firth Blakeley, Sons, and Co., Limited, *v.* the United Gas-Works Development Company, Limited, came before Mr. Justice Avory and a Common Jury.

Plaintiffs, who carry on business at Thornhill Lees, Dewsbury, sought to recover £305 17s. 11d., being the balance of account in respect of goods sold and delivered and for work and labour done in connection with the erection of new arches of retorts, annular condensers, single-lift gasholder, pipes and specials and straight lengths, in coupling mains and overhauling and repairing gas-exhausters, and other work.

Defendants, who carry on business at No. 14, Victoria Street, Westminster, pleaded that it was a term of the contract that plaintiffs should guarantee that the whole of the work would be executed in the best manner, so as to give the most complete satisfaction to defendants; that all iron and steel work should be executed in the best manner, and that the work had not been done in a satisfactory or workmanlike manner, with the result that the gas did not pass from the retorts to the gasholder, causing a back-pressure, which back-pressure might cause an explosion and prevent a supply of gas to the town. They also said that the new gasholder would not work in a satisfactory manner, and by way of counterclaim sought to recover the price of certain materials alleged to have been improperly employed by the plaintiffs.

In reply, plaintiffs denied that the work was not done in a workmanlike and proper manner, or that they had improperly removed any materials.

Mr. Frank Phillips appeared for the plaintiffs; the defendants were not represented.

Mr. Phillips said the defendants had been very vigorous up to this moment in the way of defence, but they were not present to defend the action. Defendants had promoted several small companies in various parts of England, and had work done for them; and the present action was brought to recover the balance of account for work done by plaintiffs in erecting a gasholder and retorts in order to enlarge some gas-works in which defendants were interested in South Wales.

Formal evidence having been given that the work had been done, and that the money was due, the Jury found for the plaintiffs; and his Lordship entered judgment for them, with costs, both on the claim and counterclaim.

Reservoir Embankment and a Right-of-Way.

In the Lancashire Chancery Court, before Vice-Chancellor Stewart-Smith, K.C., last week, an action was part heard in which the Bolton Corporation sought to obtain an injunction against Mr. Edward Deakin, the owner of extensive works at Belmont, a village about 6 miles to the north of Bolton, to restrain him from committing a trespass upon, and claiming a public right-of-way over, an embankment at the Belmont reservoir of the Bolton Corporation. It was also sought to restrain deliberate and premeditated incitement on the part of Mr. Deakin to the general public to follow his example in trespassing on the road. Counsel said the case was one of the greatest possible interest to the Corporation, because Mr. Deakin claimed that this embankment road was a highway for all manner of traffic. The road ran along the top of the embankment, which in some places was 86 feet high. It held up an enormous quantity of water; and there was not the least doubt that if it were decided that the road was a public highway for all manner of traffic, the safety of the embankment would be seriously jeopardized, and it would be necessary to strengthen it at an immediate cost of something like £30,000, with considerable expenditure on maintenance. In 1890, the Corporation found people were using the embankment road who were not entitled to do so, and that the embankment was showing signs of becoming insecure. They took steps to prevent the road being used by unauthorized persons, and spent money in strengthening the embankment. The defendant thereupon asserted that a public right-of-way existed; and he organized processions which he headed, on horseback, accompanied by bands of music, in assertion of this right. From that time to the present there had been recurring disputes between Mr. Deakin and the Corporation of Bolton with respect to the user of the road. No complaint was made of the defendant's use under the rights conferred upon him by his lease, but to his claim to the use of the road as a public thoroughfare. For the defendant, it was urged that the road in dispute was a public highway, having been dedicated to the use of the public in 1847, at which time the reservoir was the property of the old Bolton Water Company. The Corporation came into possession in 1854, under their Act, and, in fact, stepped into the shoes of the Water Company. There was evidence that traffic of all kinds passed over the embankment road, and that no attempt was made by the Corporation or the landowners—the Corporation not then being owners of the land—to interfere with such user. No action was taken to dispute the right of the public to use the road until 1890. Gates were put up; but they were only for the purpose of preventing cattle from straying upon the embankment. They were not locked till 1910. This came to Mr. Deakin's knowledge; and he took steps to assert the right of the public to use the road—several times removing locks and driving through. No action was taken by the Bolton Corporation in regard to these acts. Evidence was given by defendant (who declared that all his actions had been based upon the footing of his being a member of the general public) and other witnesses; but at the end of this, Mr. Deakin's Counsel announced that his client was prepared to assent to the view that the defence that this was a public highway was one which could not be sustained. This, however, would in no way interfere with the private rights of Mr. Deakin as a tenant, which were not affected. The injunction claimed by the Corporation was granted, with agreed damages of 20s., and the costs of the action.

MISCELLANEOUS NEWS.

EVIDENCE ON FACTORY LIGHTING.

Resuming, with the fifth day's sitting, the evidence given before the Home Office Departmental Committee on Lighting in Factories and Workshops [*ante*, pp. 98, 149], main consideration must be given to the statements made by Messrs. Franklin Thorp and Harvey T. Thorp, who appeared on the nomination of the Institution of Gas Engineers.

Mr. *T. E. Ritchie*, head of the Test-Room Department of the Union Electric Company, Limited, who was the first witness examined, and pointed out that he appeared before the Committee in his individual capacity, said he thought that the degree of inequality of illumination was of the very greatest importance, because this was the factor which was mainly responsible for accidents. It was the thing which created the contrast—the black spot and the bright light. He meant the bright light on the work in a lathe, and the black spots on the gear. at the back, where a man got his hand trapped, and that kind of things This consideration of the degree of inequality which could be permitted was so important that his Company's whole method was based in the first place upon the fundamental use of it. In a large new Birmingham works, the suggested limits for engineering and allied work had been fixed. The maximum allowable degree of inequality in the illumination decided upon was: Forging and smiths' work and casting and founding large work, 100 to 20, which gave a diversity co-efficient of 5. Machine shops and fitting shops, 100 to 40, which gave a diversity co-efficient of 2·5. Pattern-making shops, 100 to 50. There were, of course, many conditions under different circumstances which would necessitate the inequality being reduced—*i.e.*, the lighting made more uniform in intensity—though there was nothing, he thought, which would warrant it being increased. The figures he had been giving referred to large light units. The great difficulty all through this illumination question was that those who had perforce to acquire knowledge of it wished to retain the advantage to themselves. It had a very great bearing upon the dividend-earning capacity; and they would not divulge this sort of thing. The minimum illumination in the different shops of the works he had referred to ranged from 1·25 to 2·5 foot-candles, within the four walls, on a horizontal plane 3 ft. 3 in. from the floor. If a reasonably good minimum illumination was fixed, with a moderate degree of inequality, the final result was bound to be satisfactory. He was afraid the Committee could not fix anything in the way of a maximum; but they could very reasonably determine upon a minimum. It was impossible to get practical lighting with 100 per cent. of equality; so that the average was bound to be reasonably in excess of the minimum, whatever it might be. Taking textile work as a whole, he did not think one could get satisfaction (unless for white work only) with less than a minimum for general illumination of from 4 to 6 foot-candles, to meet the varying conditions. For the ordinary run of work, no doubt, from 2½ to 3 foot-candles would be sufficient.

The CHAIRMAN remarked that the question of the permissible degree of inequality of illumination was one the Committee had not previously had prominently before them; and it raised some interesting points. It would therefore be an advantage to the members to study Mr. Ritchie's evidence before concluding his examination.

Mr. *Alexander Siemens*, representing the Institution of Electrical Engineers, gave particulars of the lighting of Messrs. Siemens' works. For general lighting, a figure was shown of about 0·5 foot-candle; and between 2 and 4 foot-candles for individual lights. It had been found that the lighting was really too much. With regard to determining a minimum artificial illumination for workshops, it had been found impracticable to lay down general rules, nor had any special investigations been made to define such rules, as it was so easy under modern conditions to modify artificial lighting. The trial-and-error method had been acted upon; the experience gained in practice being duly considered.

The CHAIRMAN: If there were some authority which could step in and say that the lighting is inefficient and ought to be improved, would that be desirable?

Witness: I have lived so long in England that I have taken on some of the English independence. I do not like to be bothered.

We started on the supposition that it was in your own interest, not only that of the workmen?—I say the workmen and employer know their own interests perfectly well; but whether a third party knows it, I am not certain. It is essential to have a good light for good work. My difficulty is in fixing the minimum, and seeing afterwards that it is conformed to.

Mr. *R. Trebatcoff* and Mr. *A. Hillman* appeared on behalf of the Jewish Tailors' and Tailoresses' Trade Union, to ask that a standard should be adopted both for natural and artificial lighting, and also for the doing away with lighting by open gas-jets, the heat of which (as it was necessary to have them so near) had a bad effect on the workers' eyes. They recommended the use of either high-power gas-lights, with shaded globes, or electric lamps. Where good lighting was provided, they had found satisfaction expressed by the members of the Union; but the question was one which had been very much neglected. Every tailor employed in a shop should have a light to himself.

Mr. *Franklin Thorp*, who appeared with Mr. *Harvey T. Thorp*, on the nomination of the Institution of Gas Engineers, said his firm had put in something like 25,000 lights per annum for the last three years, mainly in textile factories in Lancashire and Yorkshire. Their principal business was with the spinning and weaving mills; but they had lighted many engineering shops, warehouses, &c. After carefully reading the excellent report of Mr. Wilson in the 1911 Annual Report of the Chief Inspector of Factories,* he recognized that his observations would be principally bearing out those made in the report. The artificial illumination of factories and workshops had been carried out in a very unscientific manner as regarded the actual measurement of illumination, even by some who said that they understood the subject.

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* See "JOURNAL," Vol. CXIX., p. 38, 113.

There were a great many people putting lights in factories who did not understand what foot-candles meant; but even those who thought they did, had not calculated on the foot-candle basis, except in a few instances where the gas engineer in question had particularly demanded it. Very few of the people who did the lighting had photometers which were of any use. He felt a very useful work had been commenced by the formation of this Committee; and it would be a good thing if some basis could be arrived at as soon as possible, in the interests of everybody. In addition to other points already emphasized, he would suggest as two important principles—(*a*) The system of lighting should be such that light failure should be practically impossible while the machinery was in motion; and (*b*) the light should not be subject to avoidable rapid deterioration. While agreeing with the argument that the intensity of light should vary according to the material upon which the work was being done, he was afraid it would be a difficult matter in practice to vary the candle power. It would probably be preferable to make a standard unit, and let it be sufficient for the darkest material to be worked upon, rather than have a varying one, because experience showed that manufacturers were not against giving a good light—in fact, they liked to do so. In the Nelson district of Lancashire, particularly where the turnover was the main thing, the amount of illumination given was very high. They were now putting in double the number of lights that had sufficed up to the present. They liked to arrange that there should be a minimum illumination on the work of from 3 to 4 foot-candles. This would mean a maximum of 6 foot-candles with the lights close together—one light to two looms. These figures were sufficient for either white or coloured goods.

The Chairman: Beyond the fact that the manufacturers ask for more light, have you any definite evidence that they now realize the relation between the turnover and the amount of light?

Witness: I have asked in many cases for particulars, but have been told there are so many factors that come into it that they cannot be definitely stated. We believe that they realize it; but we cannot learn definitely that it is so. The ground for this belief is that they are still increasing the amount of light.

In reply to further questions witness said he did not think there would be any real objection on the part of manufacturers if a minimum standard of illumination were specified. He had tried in some cases to put in a very large unit of light; but the loss due to reflection was such that they needed much more illumination.

The Chairman: In the case of one lamp to four looms, they are bigger lights?

Witness: Much bigger units. I believe that in the Nelson district, at one of the meetings, the weavers were insisting upon one light to two looms with the smaller unit. We found also that in the case of the smaller units, when the factories got very hot in the summer time, by using the gas-compressor, and sending air through in place of gas—it smells for a few moments, of course—it had a wonderful moral effect on the weaver. I do not think it makes very much difference in the amount of fresh air brought in; but the weaver knows something is coming in, and feels she is getting the benefit of it. With one light to four looms, there is a decreased capital expenditure—the cost being roughly, with compressor and fittings, (say) 8s. a point. If you double the number of lights, you double the capital expenditure.

Further examined, witness said he thought a test specifying a minimum horizontal illumination would not be satisfactory in all cases. Generally speaking, fixing a light 6 ft. 6 in. from the ground overcame the difficulty of glare. He showed photographs of lighting installations, and pointed out that gas-lights could be arranged so as to make it possible to raise or lower them as desired. Continuing, he said that, after careful consideration, he was of opinion that any standard of illumination which might be proposed should really be on the basis of the candle power of the light-source and the spacing. It could be safely left to the owners to arrange the best positions. Then the factory inspector might be left to decide whether the candle power of the individual units was sufficient, or whether it was equal to the minimum specified, and whether the shading of the lamp was enough to comply with the restrictions as regarded glare. In other words, his present feeling was that he would prefer to have candle power and position. The reason why this would be more advantageous than illumination (say) on the vertical and horizontal plane, was the difficulty of testing. If one could specify that the light must not be less than a 50-candle power lamp, efficiently shaded, and spaced not more than a certain distance apart, it would in many cases be possible to secure good lighting where the illumination was required. It could be specified that the curve of the lamp should be of a certain shape; and from this one should take three tests—the vertical test, and (say) 30° and 60°. Any light above 60° was of very little use when one was only allowing 12 feet apart; and anything beyond this distance could be left out of consideration. Asked what he allowed in cases where light came from the walls, witness said he was afraid they did not take this into consideration, because in some instances they were kept well whitewashed and in others not.

Mr. Paterson: Supposing a man instals in his factory a number of high lights, and then for localized general illumination a number of small ones, you could not apply a specification which only comprised cases of single lamps of that kind, because you would have to take into consideration the illumination from the high lamps, and you would have a complicated calculation before you got at what the candle power was?

Witness: That is quite true; but we meet so very few cases where it is actually done, except in engineering works.

Continuing, witness said his evidence was chiefly with regard to cotton factories and gas lighting. The advantages of candle power rather than the foot-candle were not peculiar to gas. If anyone could devise a photometer which would take a fair test, he agreed the illumination test would be the proper standard. Any regulation that was made ought to have some distinct reference to the trade to which it was applied. If it was agreed, for example, in the cotton weaving trade that there should be a minimum illumination of 4 or 5 foot-candles, he thought the specification that could be substituted for this would be so many lamps of a certain candle power, at a certain height, for so many looms. It would not be difficult to specify the particular direction in which the photometer measurement should be taken. It would be necessary to stipulate that it must be taken at right angles to the loom. The question of shading and character of fittings was very important; but unfortunately the ideal condition could only be realized at great cost. For many purposes adjustable lights with parabolic shades were very valuable, as they enabled the light to be directed as required, and effectively shaded the light-source; but except for special purposes, they were not adopted in textile factories. The question of sufficient illumination was one which fortunately appealed to worker and employer alike. There had been a tendency in the past to cut down capital cost by using one 150 candle power light for four looms; but experience had shown that two lights of 80-candle power for four looms possessed many advantages. In many cases, one light to two looms was being asked for. The question of adequate lighting must vary very much; but he should say that in cotton weaving one light of 50 candles for each two looms should be the minimum, and where horizontal illumination was permissible a minimum of 3 foot-candles. In the case of a well-illuminated yarn-winding shed, he found the lighting bill worked out at only 0·18 per cent. of the turnover. It was becoming an important matter to the manufacturer to give a good light, as, owing to the scarcity of weavers, the workers naturally chose situations which were most favourable; and he had known one or two cases where weavers in sheds lighted by flat-flame burners and carbon filament lamps had given up the work, when there were better incandescent gas-lights in a shed near by. It was interesting to note that there were still a large number of flat-flame burners and carbon filament lamps in use. Mr. Arthur Andrew, the General Manager of the Oldham Corporation Gas Department, had recently [June, 1913] taken a census of the lights in mills and workshops in Oldham, and found that there were 65,596 incandescent burners and 44,946 flat flames in use. This was a very much larger number than they expected would be still there. There must also be a large number of carbon filament lamps; and he thought both these and flat flames ought to be condemned at once, because of the small illumination they gave. The minimum candle power of the high-pressure burners he ordinarily put in was 50 candles. He had known many instances, where flat flames and carbon filaments had been in use, where the wrong colours had been put in the shuttles, and cloth spoilt. The light should be of such a quality that it would not allow of these mistakes; and they knew that the incandescent mantle was much better than either the flat flame or the carbon filament. Then, again, failure was a point of the greatest importance. Electricity, whether produced by the works itself or taken from the town supply, should work through an accumulator, or there should be a number of gas-jets burning for safety. Failure of a gas supply was almost unheard of, and need not be considered; but where high-pressure gas systems of 50 inches and upwards were used, a strap breaking or an accident to the compressor might cause light failure. In these cases, a few lights in the roof on town pressure should always be kept going. The same thing applied to systems using a mixture of gas and air or high-pressure air. Methods of gas lighting using the gas compressed to (say) four or six times the normal main pressure did not require any auxiliary light, as the volume of gas used varying with the square root of the pressure there was one-half the volume of gas passing even when the compressor was stopped; and this was sufficient to illuminate the mantle to a considerable extent. As to the deterioration of lighting by reason of dirty glassware, in his opinion, should be eliminated wherever possible. With the glow lamp, this was quite impossible; but with incandescent gas-lights he never employed glass, except for very draughty positions. A simple form of wire guard was all that was necessary to protect the mantle from danger. The dirt and dust met with in foundries, weaving sheds where the cloth was heavily sized, card-rooms, &c., was frequently the cause of rapid deterioration of illumination owing to its choking the orifices of the burner, and preventing sufficient air getting to the burner to fully consume the gas. Gauze filters had been introduced in some cases, but with little success, as the gauze was quickly choked. A correctly designed burner, however, could be, and was, used without difficulty in all but the very worst cases. He suggested that the burner specified should be such that it did not deteriorate in candle power beyond a certain amount within 300 or 400 hours. In some cases the addition of filtered air at the compressor decreased the difficulty, as only some three parts in place of five were taken from the room. This was not a cure; and they had been compelled in several instances to add all the primary air necessary for combustion at the compressor, so that no air was taken in at the burner in the room. This method of mixing the full amount of air and gas together might be thought dangerous; but they had not found any trouble, and the insurance companies had passed the system. They advised, and they always installed themselves, a safety-plug at the end of the pipe, to prevent any possibility of the light striking-back into the pipes. The nipple itself was made long, so that the heat was extracted from the explosion coming back; and then they put in a safety-plug as an extra safeguard. Another thing was that the taps which controlled the lights, in the case of suspended lights with metallic tubes, should always be placed above the metallic tube. He had known cases where they were below; and in turning them one was pulling the tube and causing it to leak. There were also no means of control; whereas if the tap was at top, one could cut off the gas supply if necessary.

Professor Sherrington: I would like to ask whether, both in the case of gas and electric light, if you double the lights would not this create difficulty in regard to ventilation?

Witness: No, because in the old flat-flame burners we were consuming about 6 cubic feet of gas for each light, where now we are only burning 2 feet. So in all cases, even where we double the lights, we have almost half the consumption of gas. On the question of heat in gas lighting, this helps to some extent, because in the cold weather you have your lights on very often, and it assists in the heating of the room to a certain extent, and also in the ventilation, by causing currents of air to move.

Mr. Parsons: Is it common to have these incandescent lamps unprotected by glass globes?

Witness: Yes. We have put in at least 100,000.

Do you get any bad effect from the rays from the lights?—I do not think so.

There is a good amount of ultra-violet rays from incandescent gas?—Yes, there is; but not so much as from a metallic filament.

You have known it in use for a long time without any bad effect?—

I have not noticed any bad effect at all for the last six or eight years. And no complaints from any source. We have had no cases where we have had any real glare.

There is a very considerable absorption of ultra-violet rays by clear glass, and this prevents a good deal of the trouble from electric light. I was wondering whether it was sufficient protection from incandescent gas under pressure ?—At very high pressures you may get more ultra-violet rays; but with the usual 6-inch pressure I think the amount of ultra-violet is not sufficient to do any harm, even without shading. I should say that we find the flickering of the arc—that is to say, the unsteadiness of the light—has more effect on the eye than any ultra-violet rays. There is a mill in Bolton where they have both indirect arc lighting and inverted incandescent gas lighting under one roof. There is just a division wall between. That is, the two systems are working side by side in the same mill, and under the same management. We have an installation in there which is working satisfactorily; and the workers much prefer the incandescent gas-lights.

Mr. *John Taylor*, Secretary of the Cotton Spinners' and Manufacturers' Association, spoke of the advantages of high-pressure gas. He did not think there was much trouble with regard to efficient lighting in weaving sheds, because it was to the employer's advantage; but he did not see how it would be possible to fix a standard.

Mr. *Thomas Shaw*, Secretary to the Colne District Weavers' Association, and representing the Amalgamated Weavers' Association, stated that during the last few years there had been considerable improvement in the illumination of weaving sheds; and there was still room for more. The lighting generally had been improved, owing to the introduction of the incandescent mantle. There was very little electric light. Factory inspectors should have power to insist on an adequate light. He believed this was the only solution. The work differed so much that it would be impossible to fix any hard-and-fast rule. One light to four looms be considered inadequate.

The CHAIRMAN : Suppose we came to the conclusion that a certain definite amount of light was necessary, and then suppose we provided that on every part of the work not less than this amount of light must fall?

Witness: That will be perfectly satisfactory.

Mr. *W. C. Robinson*, the Secretary of the Amalgamated Society of Beamers, Twisters, and Drawers, said that incandescent gaslight might fairly be called satisfactory. As to electricity, there were various opinions; but he thought the general idea was that it was the best, so far as his workers were concerned. He would like some provision which would make it practicable to illuminate the whole of the work satisfactorily; and this was possible.

Mr. *A. Hutchison*, Secretary of the National Union of Stove Grate, Fender, and General Metal Workers, asked whether he thought it would be possible to make regulations which would secure that more light would be available where it was wanted, said he believed that in most cases it was a matter of expense. He handed in a list of practical suggestions for improving the lighting. It was his opinion, he added, that a standard of illumination could be fixed. In foundries, the worst-lighted parts were where the moulders worked.

COAL TAR AND ITS PRODUCTS.

Last week there was reproduced from the "Iron and Coal Trades Review" an article on this subject that has called forth a letter from a correspondent, writing under the *nom-de-plume* "Distillation," who says he "has no desire to 'wet blanket' any efforts being made to retrieve the chemical trade which has been largely in the hands of our enemies, but thinks many of the statements in the article are exaggerated and misleading, and should not be allowed to pass unchallenged."

Having mentioned that he read the statements made in the article with "interest and amazement," he proceeds: It is stated that the results given under various heads have been obtained under everyday conditions, and have been amply substantiated in plants actually at work. As the figures and data have been supplied by Messrs. Hird, Chambers, and Hammond, of Huddersfield, it may not be too much to ask where the plants are at work, and if permission can be obtained to view them. The figures given as to quantities of products, prices, and profits, are, in the opinion of the writer, quite different from what other tar distillers can obtain.

For example, is it an everyday condition to obtain 26 gallons of light oil from one ton of tar? Can the prices of the various oils as given in the first estimate in the second column of the article be obtained at any works at the present time? With regard to the quantities of benzol, toluol, &c., are these calculated, or are the quantities based on actual results?

The rectification of benzols may be a simple process; but to rectify to the War Office specification certainly requires more attention in supervision "than is obtainable from men who have no previous experience in distillation."

The article states that, on 60,000 gallons of benzol, the working charges would be £279. This is, roughly, 1d. per gallon. The writer knows this to be an absolute impossibility with sulphuric acid and caustic soda at their present prices.

The most startling statement, however, is that with regard to crude carbolic and cresylic acid—viz., that one ton of average tar contains 3 gallons of each; and that "a very simple type of plant" is required for the recovery of these products. It would be most interesting to have further particulars of this simple type of plant, and where it may be seen in actual operation. The writer suggests that if 1½ gallons of saleable carbolic acid are obtained from a ton of average tar working under everyday conditions, the results may be regarded as being satisfactory.

The object of the statement of the results based on prices ruling in 1913 is difficult to understand. The war has upset the prices of all tar products. Tar is difficult to sell at anything over 12s. per ton; and huge stocks of pitch have accumulated in the country, for which it is difficult to get £1 per ton.

GERMAN CONTINENTAL GAS COMPANY.

Report and Accounts for the Year 1914.

The following is a summary of the contents of the report for last year of this Company, whose head office is at Dessau.

The issue of the report has been delayed owing to the difficulty of obtaining early information of the position of the Company's undertakings in hostile countries. The quantity of gas sent out from all the Company's works in the year was 98,085,273 cubic metres [about 3,463,981,400 cubic feet], which is 0·82 per cent. less than in the previous year. The reduction is solely due to the falling off in gas consumption during the last five months of the year, after war had broken out. The increase in expenses caused by the war reduced the gross profit to 4 273,213 marks [about £209,470], as compared with 4,688,509 marks in 1913. It is proposed to pay a dividend at the rate of 8 per cent.; to assign 1,250,000 marks to the renewal fund, which has been drawn on much more heavily than in the preceding year; and to create a new war provident fund of 230,000 marks.

The falling off in gas consumption which occurred at the beginning of the war subsequently vanished—largely owing to the scarcity of petroleum; but it is anticipated that many of the new gas consumers thus obtained will continue to use gas after the war is over. Unfortunately, scarcity of fitters has prevented new connections being made as quickly as called for. Coal has been dearer than in 1913, and after the outbreak of war often inferior in quality. Bye-products, especially coke, have given lower returns. The central workshops at Dessau have been utilized for the manufacture of munitions, for which their equipment was admirably adapted, and thus the whole of the workmen engaged there have been kept in employment at good wages. The interest held by the Company in other undertakings had been largely increased the previous year; and though these undertakings in Germany were affected by the war, their development would not suffer, and they would make good profits on the return of normal times.

In consideration of the introduction of a "flat" rate for gas at Frankfort-on-the-Oder, the Company had obtained an extension of their concession there by twenty years—viz., until the year 1940. The apparatus (tar-extractors, scrubbers, exhausters, &c.) at the Company's Dessau works was overhauled during the year and extended to a capacity of 1,765,000 cubic feet per diem. The former municipal gas-works at Odessa, which had just been taken over by the Company under a concession, showed an increase in output during the early part of the year; but since the outbreak of war there had been no direct information in regard to the works. The Company's various electricity works made good progress; and the supply of current was undertaken in the districts round Nordhausen and Elbgau, in which the Company have already supplied gas. After the outbreak of war, however, the State embargo on copper hindered the further extension of the electrical undertakings of the Company.

The increase of the capital of the Company to 28,200,000 marks [about £1,382,350], decided upon at last year's general meeting, was carried through, and the new shares to the amount of 4,200,000 marks receive the full dividend this year. The issue of bonds to the value of 6,000,000 marks, authorized in the previous year, was not proceeded with, owing to the outbreak of war. No fewer than 523 officials and workmen had been called to the colours from the Company's German works by the end of the year.

The report adds that since the beginning of the current year there have been increases in gas consumption, as compared with the corresponding months in peace-time, and that the returns from bye-products have improved. The difficulties in obtaining supplies of coal have, however, grown, and the considerably higher prices which are being paid must affect adversely the results of the current year's working, as the Company must abstain from raising the price of gas in view of their obligations to the public at the present time. The Company's gas and chemical works at Warsaw were sequestrated by order of the Russian military command on Dec. 22 last, but were restored to the Company by the German Government on Aug. 22, and have since been worked by it. They were in good condition when handed back in August.

DANISH GAS COMPANY.

The Annual Meeting (the 61st) of this Company will be held in London on Thursday, when the Directors will report that the net revenue for the year to June 30 was £66,673. Adding the £61,280 brought forward from the last account, the total credit to the profit and loss account is £127,953. After charging the debenture interest and loss on exchange, which is said to have been exceptionally heavy, and setting aside £10,000 to the reserve and redemption account, there remains £104,264 available for dividend. Interim dividends of 2½ per cent. on the preference shares and 5 per cent. on the ordinary shares have already been paid; and the Directors will recommend that there be declared dividends of like amount on the respective shares. These dividends will amount to £43,500, and will leave a balance of £60,764 to be carried forward. There was charged to capital account during the year, for additional buildings, apparatus, mains, &c., £24,068.

As stated in the last report, the Company's business is suffering financially from the effects of the war—especially as regards its supplies of coal, material, &c. There was a decrease of 3 per cent. in the gas sales, as compared with the previous year, although the number of meters fixed on June 30 last was 2074 more than on June 30, 1914. The Flensburg works of the Company have not been interfered with beyond the appointment of a Controller by the Prussian Government to regulate the Company's local finances, &c. The Company's relations with the town authorities are, as usual, quite satisfactory.

The report of their Engineer and General Manager in Denmark (Mr. A. W. Edwards) mentions that the total gas consumption was 1,082,337,000 cubic feet, against 1,116,250,000 in the previous year—being a decrease in the consumption of 33,913,000 cubic feet, or 3 per cent. This decrease was caused by the European war. It was especially during the quarter ended September, 1914, that the consumption decreased considerably. With the exception of Frederiksberg, where there is still a falling of, as compared with the previous year, the stations have, during the last few months, gradually worked up to about the normal output. The Flensburg station is still in the hands of the Company; but the Prussian Government are controlling the business. This does not, however, interfere with the management. The new holder at Odense has been completed and taken into use. The consumption in the St. Hans district is increasing satisfactorily, and new trunk mains are being laid. A new trunk main is being carried through part of the town of Elsinore, and a new retort-house will probably be built in the course of next year. The new naphthalene washer referred to in the last report has been fixed and taken into use at Viborg. The consumption at Assens is progressing satisfactorily. The mechanical plant in connection with the vertical-retort house at Strandvel has been completed and is working to satisfaction. The gas-producing plant needs extending, and the foundation for the extension has been commenced. A new gasholder is being erected here. A new naphthalene washer has been fixed at Frederiksberg and taken into use. The extension of the Ribnitz works is nearly completed, and all the new apparatus has been taken into use. This station is in good order, and the works quite undisturbed by the war. The Horsholm station is progressing satisfactorily. The prices for tar and ammonia products have been lower during the last year, but the price of coke has been good. All necessary alterations and repairs will be completed before the winter, Mr. Edwards concludes by stating, and the stations will be in good working order.

THE FATAL EXPLOSION AT BECKTON GAS-WORKS.

Inquest.

At the East Ham Central Hall last Tuesday, Dr. Collins, the Deputy-Coroner, held an inquest with reference to the death of Jacob Francis, aged 29 years, a stillman's assistant, who was fatally injured at the products and chemical works of the Beckton Gas-Works on Monday morning of last week [*ante*, p. 159].

Mr. Beasley Robinson appeared on behalf of the Gas Light and Coke Company; and Mr. Butler, one of H.M. Inspectors of Factories, represented the Home Office.

The Coroner said that some benzol was being removed from one of the drums when without any warning some fumes were seen to be coming away from it, and there was an explosion. The question was as to whether this was a case of spontaneous combustion, and whether it was necessary to take precautions in the way of electric torch lights, preventing smoking, and so on. There was, unfortunately, no one alive who could give any explicit details as to the affair, and they would have to do the best they could.

Henry Francis said he was in the same employ, and was practically doing the same work, as his son, the deceased. He did not consider the work was dangerous so long as it was carefully carried out. He saw the remains of the body in the mortuary and identified them as those of his son.

Frederick Paine, foreman of the department where deceased was employed, said deceased worked under the supervision of a man named Morris, who was experienced. The department was in perfect running order when he left it at 9.50 p.m. on Sunday evening. There were rigid rules as to carrying matches or smoking. The men themselves knew they were liable to be blown to atoms if they did so. The place was fitted throughout with electric lamps, and the men were provided with electric hand lamps. He had never heard of a bulb breaking there or anywhere else; and if it did, there would not be sufficient vapour to explode. The explosion took place at 3 o'clock in the morning, and the benzol was running into the drums. The drums were of 50 gallons capacity, and took about three hours to fill. There was a naked stream from the retort into funnels and thus into the drums, which was the usual process. There should be no vapour from the taps, as the condensation was so good. The liquid would be so cold that no vapour should arise, and there would be practically no smell. He could give no reason at all for the explosion, not even by a leak from the retort. The lid was never lifted except for cleaning purposes. From time to time the drums were inspected to see that they did not overflow; but samples were not taken at that particular time. All the electrical fittings were outside the plant house; so that there was no chance of a fuse blowing out on the switchboard. To his knowledge all the joints and the machinery were tight and sound.

By the Foreman: The whole of the men wear their own clothes while at the work. The floor is of concrete.

The Coroner: Then there is a possibility of a spark from a nail from a boot?

The Coroner's Officer: The witness is mistaken, the floor is not concrete.

In reply to the Coroner, witness said he had no idea where the explosion originated.

By Mr. Butler: Portable hand lamps were the only ones used in the buildings. To see how the drum was filling, the funnel would be removed; and the inside of the drum could be seen by the electric light above. A hand lamp was not necessary.

By a Juror: He had heard of cases of drums being overfilled. When they lifted funnels they did not take them right out, so that there was no chance of any drips falling; they could see without that.

Mr. *Gordon Adams*, the Works Manager at the Beckton Gas-Works, said that, so far as he knew, everything was in working order. Usually he went round every day, but he had not been round this particular spot on the Sunday. There were 80 acres of works, and it was rather an extensive job. The plant house employed was the usual, and had been in use for the past 35 years. Machinery had been altered from time to time. He had never heard before of a fire or an explosion. The floor was of concrete, with wooden gangways, simply for the convenience of moving the drums.

In reply to the Coroner, witness said he did not think that rolling the drums on the concrete would cause a spark. It was possible, but he had never heard of it. He had no idea of the cause of the explosion. He had tried to find out by an examination of the building, but it was too badly damaged by the fire to give any clue. The still was quite perfect; so that it was proved the explosion was caused in the building.

The Coroner: Would it be possible to cause the explosion by malice, by an incendiary?

Witness: It would.

By a match it could be done, I suppose, or a spark?—Only if the vapour was there.

Replying to further questions by the Coroner, witness said that this benzol was low-flash, and would have to be set fire to by a match or a spark—it would not be caused by spontaneous combustion. All the electric lamps were enclosed in double glass cases, and the wires were in steel cases, as were also the leads. The vapour would not be able to be seen; it would not be of sufficient density. Anyone who spoke of seeing vapour must mean steam. Thousands of drums were filled in exactly the same way as this.

By a Juror: The nearest naked light to the drums was 35 feet away. He was not aware that it was actually burning at the time. The stills were all covered with non-conducting material. There was an ample supply of water for the Fire Brigade; there were ten hydrants on the fire almost immediately.

By the Coroner: There was a gas-stove in the fire station 35 feet away; but if the wind was blowing from the stillroom in this direction it would be a long way for fumes to be carried.

Chas. Morris, a stillman, was then called. He said they had never had a better night for the stills; everything was going splendidly. At 5 minutes to 3, witness's mate, the deceased, was in the benzol stores with him. He looked in the drums and saw one wanted 3 inches, another 9 inches, and a third 12 inches. Witness then went to look at another still in another house, and had just got back when there was a tremendous explosion at the far end of the room, which seemed to start at the bottom of the wall and blow up to the top. There was a dull, heavy boom as the explosion occurred. This was not a serious explosion; it was what happened afterwards that caused the damage. Realizing the dangerous nature of the stuff, he called to his mate to get out, and they ran out together. Deceased rushed towards the fire station, while witness turned to the right and called to the boilerman to "shut off all against us." Then there was another terrible boom, and the whole place blew up and all the material was flung over the yard. Witness turned his back to the building, and dropped on his knees, which saved his life; but even then he had his coat burned off his back, and all the hair off the back of his head.

In reply to Mr. Butler, witness said if they desired to make a cup of tea they used a steamer, which was the same heat as was used for the distillation of the benzol. The first explosion caused the largest still to be dismantled, which directly after exploded. This could not have occurred unless there had been a fire to explode it. He was quite sure his mate had no light in his hand at any time.

A Juror: If there were a leak would you smell it?

Witness: Yes, at all times. We should notice it and find it, otherwise the stuff would get down the drain and cause trouble; it is my job to look for leaks.

John David Harris, a fireman in the employ of the Gas Light and Coke Company, stated that he was on duty on the night in question, and heard an alarm given. On going out he met Morris, who said there was something wrong with the benzol. He said he thought it would be all right, and seemed to think it was a matter of a leak or a burst. He did not appear to think the danger was over, but witness understood him to mean that it would be safe from fire. Witness cautioned him as to the fumes from the benzol, as on the floor of the plant house, or about 6 inches above it, he saw what looked like a steamy vapour, which he was sure was not smoke. At the time the electric lights were full on. There were plenty of smoke helmets and respirators ready to hand had they been required. Next there was a hissing, rushing noise, which was followed by a terribly loud explosion. Witness saw no flash. He was thrown to the ground immediately. He realized on getting to his feet that the benzol had exploded. The concussion of the explosion set the electric fire-alarm bells going, and the fire brigade got to work. A few moments after he found the deceased man's mangled body. Some years ago there was a slight fire in the benzol store.

By a Juror: He only heard the one loud explosion. There was no benzol running about alight that he saw, either inside the place or outside. There was a drain it would run down.

By the Coroner: It was the building itself that was alight; while the benzol was running over from the top of the towers as the distillation was put out of order.

By Mr. Butler: He had never before seen the steamy vapour that had been referred to.

Dr. *John Guest* said he was called to the deceased, and found him charred from head to foot; all his clothing had been burned off him. He must have been in the midst of dense flames, and death was due to shock.

Chas. Morris, recalled, said he filled the still by a steam-pump. As a fact the still had been filled before he arrived on the Sunday, and the carbon bisulphide had run off. If the steam-pump or the valves had jammed, then the benzol would run off into the receivers or the drums; and it was his duty to see that there was no mistake.

The Coroner said that was all the evidence he proposed to call, and it was for the Jury to find a verdict as to whether or no everything was as it should have been, or anyone was to blame.

The Jury returned a verdict that the deceased died as a result of shock from an explosion of benzol, but there was no evidence to show how the explosion occurred.

The Coroner: You can find nothing to lead up to it?

The Foreman: No, sir.

The new season's gas-fittings catalogue of Messrs. J. & W. B. Smith, of Farringdon Road, E.C., offers a very wide selection of lamps, pendants, burners, mantles, globes, and sundries. A number of well-known patterns of inverted burners and shop and outdoor lamps are included in the list; and the glassware illustrated is of all kinds and suitable for all purposes.

BIRMINGHAM AND ITS GAS SUPPLY.

Appeal for Economy by Gas Consumers.

Last Tuesday's meeting of the Birmingham City Council had to eal with the report of the Gas Committee (given in last week's sue of the "JOURNAL"), which afforded Alderman Sir Hallewell ogers an opportunity to appeal to consumers to economize in the use gas during the forthcoming winter. With their help, he said, the ommittee felt that the abnormal demands would be met without any terruption.

Sir HALLEWELL ROGERS moved the adoption of the Gas Com- ittee's report, which it may be remembered contained a recommen- ation instructing the Finance Committee to obtain sanction to the orrowing of £35,000, part of a loan previously granted and now re- ired for further carbonizing plant. The abnormal increases in the itput, he said, rendered absolutely necessary the extensions of plant oposed at the Nechells works. With the high prices prevailing for l materials and labour, the Committee naturally desired to postpone e placing of the contracts till the latest possible date; but the abnor- ally heavy demands that were now being made for gas, which were eyond all anticipation, rendered it absolutely necessary that the ex- nsions should be ready for the winter of next year, and, having in ew the possible delays which might occur in the supply and erection materials (consequent upon the uncertain state of the market), the ommittee felt that the contracts should be placed immediately, in order ensure the whole of the plant being in operation by October, 1916. e filling-up of No. 2 retort-house at Nechells was merely the com- etion of a scheme which came before the Council so long ago as ebruary, 1898; but, owing to the increased output of gas obtained om the other works of the department—due partly to the renewals of d plant and to the increased yields of gas per ton of coal carbonized the Committee had, fortunately, been able to delay the installation the final portion of the plant then obtained for Nechells, and had us spread the expenditure of the amount sanctioned over a very much ger period than was at the time thought possible. The Council uld realize the effect on the productive capacity of the increased eld of gas per ton of coal when he told them that for the year ended arch, 1902, the average yield of gas per ton of coal was approxi- ately 9800 cubic feet; whereas during the year ended March, 1915, it s 12,000 cubic feet—an increase of 22 per cent. In view of the fact at the extensions proposed were rendered necessary by the extra- dinary demand for gas by munition contractors, the Committee did t anticipate any difficulty in obtaining the necessary authority from e Government departments. Practically, every Government con- ctor in the area supplied by the Department was dependent on the intenance of the gas supply to enable him to fulfil his contracts. art from engines, a number of gas-heated furnaces for the melting of metals had been installed in the various munition factories, and were being used night and day throughout the district.

Continuing, the Chairman said that the Committee were fully alive to the difficulty of giving a full supply of gas in all these circumstances during the next winter; but they anticipated being able to do so. Everything depended upon factors which were, to a large extent, beyond their control. The first of these was the great scarcity of suitable labour at the gas-works; and then there was the question of coal supplies. The gas consumers generally could help the Committee in the matter of economizing as much as possible the use of gas. With their help in this direction, the Committee felt that the abnormal demands would be met by the Department without any interruption. Some people thought that the diminution of public lighting must have had some effect upon the supply of gas. The figures for the half year ended Michaelmas showed a decrease for public lighting of 44 million cubic feet for the six months, which was something like 2 per cent. of the output—certainly not more, although, of course, in shop lighting there had also been a decrease.

Referring to the remarks of a member earlier in the meeting, with regard to the price of coal, Sir Hallewell said some rather unfair deductions were made. He had explained to the member in question that it was very difficult to compare the figures, and that they were going to pay probably £160,000 to £200,000 more this year than last year, because they were not buying the same quality of coal. The London companies, owing to the fact that they were unable to get coal by water, came into the Midlands for it; and the result was that the prices of coal went up. But the Committee were buying, in many instances, a very much better quality of coal; and therefore they were getting more gas out of it, and were obtaining more for their tar, liquor, and coke. It was hardly fair to take the one figure and then compare it with the other. The Gas Committee did not buy the same coal every year, and comparisons of money were only too apt to mislead. In giving the figures, Sir Hallewell Rogers made it quite clear that no account had been taken of the quality of the coal. Their coal was costing at least 4s. to 5s. a ton more than last year; but it was not always the same coal. In many instances it was better coal; and therefore they were getting something more from it than when they were paying 4s. a ton less. Therefore it was very misleading to give figures of this kind.

The report was adopted.

A CONTRACT AND STORES COMMITTEE SUGGESTED.

Later on in the same sitting, Mr. Gaunt moved the following resolution: "That the General Purposes Committee be instructed to report at an early date as to the desirability of forming a Contract and Stores Committee for the purchase of all stores which are common to several committees." The formation of such a Committee, he maintained, would result in a very great saving in expenditure. Articles which were to be purchased could be standardized, and proper expert exami-

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nation could be arranged. Their orders would be large enough to enable them to go direct to the manufacturers, instead of to the dealers. Large manufacturers had repeatedly refused to tender for the comparatively small quantities of articles required by one committee It would also mean an encouragement to local manufacturers; and the fair-wages clause could be better enforced than at present. At the present time the Birmingham Council had fifteen committees purchasing the same commodities. The Gas Department purchased every year hundreds of thousands of pounds' worth of coal. On the other hand they had fifteen committees each purchasing smaller quantities, at various prices; and it seemed advisable that the one expert who bought this large quantity should also buy, or advise in the buying of, the other fourteen committees' requirements. The resolution was carried.

CHELTENHAM GAS-WORKERS' STRIKE.

Board of Trade to Arbitrate.

Recently a hundred of the employees of the Cheltenham Gas Company struck work, as the result of the Company refusing to concede an advance of 3s. 6d. a week to them as a war bonus. All branches of the workmen were concerned in the strike. Last Saturday week public notice was given by the Company that, "owing to the sudden strike at the gas-works, and the scarcity of labour available to keep up the supply of gas, the Directors regret that they may be compelled temporarily to close-down the works until sufficient hands can be obtained or the men return to work."

The recognition of the men's Union is one of the questions on which there is a difference of opinion. In a statement to the Press, Mr. James Paterson (the Engineer and Manager of the Company) said that a short time ago an application was put in by the Amalgamated Society of Gas Workers and General Labourers on behalf of some of the men, for payment of a war bonus to all the Company's workmen other than lamplighters. This application was a distinct contravention of the mutual agreement come to in January last, and should have been laid before the Engineer privately by the workmen or a deputation. More recently, personal applications were made by a considerable majority of the workmen for a war bonus; and these, after due consideration, were in all cases granted by the Directors.

At a meeting held on the Saturday morning, the Company decided to instruct the Engineer to inform the men that they were willing to accept the arbitration of the Board of Trade, if the men would go back at once. Councillor H. Simpson, of Birmingham (the General Secretary of the Society), during the afternoon interviewed Mr. Paterson at the works; and there and then arrangements were come to that the whole matter should be referred to arbitration—all the men to be reinstated in their former positions. The Strike Committee having met eventually decided to adopt this course and suspend the strike; and the men resumed work on Sunday week at 2 p.m.

MANSFIELD GAS AND WATER UNDERTAKING.

Resignation of Mr. W. J. Rendle Baker.

Mr. W. J. Rendle Baker has tendered his resignation to the Mansfield Corporation of his position as Engineer of the town's gas and water undertakings. The matter was brought under notice at the last meeting of the Council, on the 15th inst., under the presidency of the Mayor (Alderman D. H. Maltby), when a letter was read from Mr. Baker and referred to the Gas Committee. In moving the adoption of a report of the Committee, the Chairman (Mr. T. Smith) said the time was not opportune that night for going into the Auditor's statement in relation to the undertaking. It had first to come before the Council in committee; and they all knew the reason why he did not propose to make any comment upon it at present. The Committee's report was adopted.

In subsequently moving the levying (which was agreed to) of a district rate of 1s. 11d. in the pound, the Mayor alluded to the adverse effect upon the municipal financial position of the inability of the Gas Committee, owing to the past year's working of the undertaking, to pay over the sum of £1500 which it had been estimated they would be able to contribute in relief of the rates. He referred, however, with gratification to the circumstance that the two other Corporation trading concerns, represented by water and electricity supply, had come to the assistance of the Finance Committee in a splendid way. On behalf of the town, he congratulated the Water Committee on contributing a further sum of £500 (making the total of £2500 available towards the rates for the year); and the Electricity Committee for granting an additional £1000, making £1600 in all out of a profit made by them last year of £1900.

WAGES ARBITRATION AT COATBRIDGE.

An Interesting Award.

The recent strike among the stokers at the Coatbridge Gas Company's works ended in the men returning to work pending their demand for 3d. a day increase in wages being referred to an Arbitrator. Bailie Robert Irvine, one of the local Magistrates, was chosen to arbitrate; and he heard evidence and arguments by Mr. Graham Hunter (representing the Company) and Mr. Peter Campbell (Organizing Secretary of the Municipal Employees' Association) on behalf of the men. He has now issued his award, which has some features of general interest, and which is as follows.

Before dealing with the basis upon which my decision is given, several observations regarding statements submitted by Mr. Graham

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Iunter and Mr. Peter Campbell, when we met to hear evidence, might e made.

As to Mr. Campbell's contentions. (1) I cannot consider that the triking of men comes within the scope of arbitration, as in most of his rguments Mr. Campbell contends for a comparison between Coatridge and other gas-works, where working conditions are as nearly s possible similar. (2) For the same reason, while admitting that the ost of living has increased, Coatbridge is not unique in this respect; nd if a comparison is to be made, and other towns are similarly laced, it can have no influence on the question to be decided. (3) The nfluence on wages where men are organized comes under the same ategory, when the whole of the conditions are to be taken into conderation. In any case, the gas-works in the towns of Airdrie and Iotherwell are municipal undertakings, which in a great measure, if ot entirely, balances any difference which might be claimed to issue om organization, or the lack of it.

As Mr. Hunter in his evidence dealt principally with matters of fact uite open to investigation, and which will be dealt with when a comarison comes to be made between Coatbridge and the other places have visited, the only remark I would make is that I entirely agree ith him, as a result of my own observation, when he asserts that the hysically best class of men are to be found in Coatbridge.

In Airdrie, Coatbridge, and Motherwell the number of hours worked re the same—viz., 13 hours. The number of holidays are the same in irdrie and Coatbridge—viz., 7.

—	Airdrie.	Coatbridge.	Motherwell.
	Tons Cwt.	Tons Cwt.	Tons Cwt.
uantity of coal handled per man per shift . .	2 16	2 15	2 2
etorts per man per shift	12	24	16
'eight of charge . .	About 4½ cwt.	About 2¼ cwt.	About 2½ cwt.
'ages	5s. 9d.	6s. 3d.	Different wages paid—3 at 6s., 3 at 5s. 9d., rest at 5s. 6d. Average, say, 5s. 9d.

The foregoing are matters upon which there is no room for differnce of opinion, as I have personally verified them on indisputable vidence. The question now arises, What are the factors for and gainst the granting of the 3d. in dispute?

(1) Taking the case of Airdrie, the quantity of material dealt with is ractically the same as in Coatbridge; while the wages paid are 6d. er day less in Airdrie. But, in my opinion, this difference is fully alanced as follows: Only 12 retorts are dealt with in Airdrie, as comared with 24 in Coatbridge; and in the latter case more work is enailed in the opening and luting-up of doors, and there are two operations in disposing of the same amount of material which in Airdrie is done in one operation.

(2) In Airdrie, cleaning of fires is only performed once in 24 hours, except in exceptional circumstances, when material is very dirty. In Coatbridge, fires are cleaned every 12 hours.

(3) While I felt that, for the purpose of abritration, it was unfair to consider the points submitted by Mr. Campbell to which I have alluded, there is a factor which, in my opinion, should be taken into consideration. That is, what rent a man has to pay for accommodation suitable to his position. I am convinced that, on an average, the rents of houses such as stokers, &c., occupy are 7 to 8 per cent. cheaper in Airdrie than in Coatbridge; and though rates are slightly higher in Airdrie, this is balanced by the lower rates.

Another point is the distance the coke has to be wheeled in the open air after being cooled. The average distance in Airdrie is 40 yards at most, while in Coatbridge it is 2½ to 3 times this distance; and the longer distance, in my opinion, not only entails more physical exertion, but is likely to offer greater opportunities for men catching cold when perspiring freely as stokers do. Taking all factors into consideration, my opinion is that the Coatbridge men, despite the 6d. extra per day, are not quite so well placed as are the stokers in Airdrie.

Then, as compared with Motherwell, in Motherwell the quantity of material dealt with is 22½ per cent. less than in Coatbridge. Wages are, however, 8 per cent. lower. Each man has 16 retorts of 2½ cwt., as against 24 retorts of 2¼ cwt. in Coatbridge. There is (but to a lesser degree in Airdrie) a saving of work consequent on the opening and luting of doors. It is clearly understood in Motherwell that the maximum amount that each man will deal with per shift shall not exceed 2 tons 2 cwt. Fires are cleaned twice in 24 hours, as in Coatbridge; distance to wheel coke, 30 to 40 yards; ten holidays per annum [one of which is a Sunday, but as full Sunday work is carried on the whole year it means ten working days]. Then, as to other conditions, rents and rates are largely the same as in Coatbridge, particularly so as regards working men's houses. I do not think that there is very much difference between Motherwell and Coatbridge.

After very carefully comparing the three towns visited, and in which stoking by hand is carried on, I have come to the conclusion that some slight increase on present wages should be granted to the stokers in Coatbridge. I must confess that I had some difficulty in fixing the amount. However, I am convinced that 3d. per day increase would put the Coatbridge stokers, all things considered, in a relatively better position than the stokers in the Airdrie and Motherwell Gas-Works. I would note, however, that apart from opinions as to the wisdom of, or necessity for, Sunday work, the men in Coatbridge are deprived of the extra remuneration paid for such work once in every three weeks, which amounts to about 3s. 11½d., or over 1s. per week.

As full-time Sunday work prevails in Airdrie and Motherwell, I am of opinion that 2d. per day increase should be granted to the stokers employed by the Coatbridge Gas Company, as from June 6, 1915, and decide accordingly.

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EATON IN ANOTHER GUISE.

Proceedings took place at a recent sitting of the Haywards Heath County Court which it is hoped by our contemporary "Truth" the Adjutant-General will give his attention to; the fact having been brought out that two officers of the 4/9th Battalion of the Middlesex Regiment are old ornaments of the financial section of that paper's "Cautionary List." It appears that one of these officers, Lieutenant H. Hollis, was sued by a local firm for £17 for hire of motor cars, work done, and goods supplied. The lieutenant denied his responsibility—suggesting that the gentleman responsible for the debt was Colonel Edmund Eaton, "now his commanding officer in the Army, and formerly his employer in the businesses which earned both of them niches in 'Truth Cautionary List.'" Some of the orders received by the plaintiffs were in writing, and signed by Hollis; but his explanation was that he signed these on the instructions of Colonel Eaton, though the cars were for private trips. Colonel Eaton, on the other hand, repudiated liability, and did not attend the Court. The evidence of a sergeant showed that a house called "The Meads" was known as the officers' mess, though there was no mess. Practically, Colonel Eaton lived at "The Meads," and ran it; but, it is added by our contemporary, "furniture, linen, &c., were borrowed for use in this establishment, and debts to tradesmen incurred, on the representation that it was the 'officers' mess.' Hollis signed an order for the water supply, as President of the non-existent mess, but repudiated his liability, and only paid the rate after being summoned before the Magistrates." In giving judgment, his Honour Judge Mackarness found that liability could only be fixed on Lieutenant Hollis for certain items amounting to £10 10s. 6d.; but he made some strong remarks regarding the non-appearance of Colonel Eaton in a matter where his name figured, and where "very serious allegations of dishonourable conduct were made."

Commenting upon the case, "Truth" says:

> For years Edmund Eaton has been notorious as a company promoter and share-pusher who, by means of flagrantly deceptive prospectuses and circulars, has involved unwary investors in heavy losses. In these schemes, Hollis has frequently figured as director. manager, or secretary; being also variously described as "a stock and share broker," as a "surveyor and estate agent," and as a "C.E." What are known as the "Eatonesque" enterprises have generally come to an end without unpleasant consequences for anybody but the victims; but a year or two ago Eaton and others were indirectly brought to book for a particularly impudent attempt to impose upon the public. A prospectus of a wretched concern styled the South of England Natural Gas and Petroleum Company was issued, bearing, immediately under the title of the Company, the names of Lord Fisher and his eminent colleagues of the Royal Commission on the Fuel Supply of the Navy; the object evidently being to lead the public to suppose that they were associated with the Company. The *suggestio falsi* was conveyed so skilfully that the Public Prosecutor came to the conclusion that its authors could not be proceeded against ont hat ground. But they were summoned for issuing the prospectus without an imprint; and on this technical charge Eaton was heavily fined. One would not recall these matters if Eaton and Hollis, having somehow got Commissions, were now conducting themselves as officers and gentlemen. But the case at Haywards Heath—only one of several in which tradesmen have been similarly treated—indicates that they have carried into military life the same laxity of principle which marked their doings as civilians; and for the honour of the army, steps should be taken to prevent the possibility of further scandals of the same kind.

STREET LIGHTING AT RICHMOND.

There was a long discussion at the last meeting of the Richmond (Surrey) Corporation upon the respective charges of the Richmond and the Brentford Gas Companies. The question cropped up on the report of the Highways Committee referring to the street lighting accounts for the June quarter, which stated that the Committee had received and considered the explanations of the two Companies as to the deductions made for unlighted lamps. These explanations had been accepted by the Committee and the accounts passed for payment.

Mr. Towers said that the charge of the Richmond Company was 7s. 2½d. per lamp more for the Lady day quarter than that of the Brentford Company; and they now wanted to charge for the Midsummer quarter 10s. 2½d. more per lamp lit. Taking the lamps at normal times, the difference between the Brentford and Richmond Companies was 1s. 5½d. per lamp per quarter. The recommendation was misleading, as the Richmond Company had never given any explanation. They stated that they would adopt the same system as the Brentford Company; and the Council's Accountant told them that, if the Brentford Company's reductions were to be applied to the Richmond Company, the charges should be applied as from October, 1914. This called for a revision up to Christmas. Now the Richmond Company said they would not go into that. There was £85 more on the bill, and they had no explanation. He moved that the account should go back.

Alderman Edgar suggested that the Highways Committee should consider the expediency of doing what was done in some districts—instead of lighting every fourth lamp and obscuring it, they should light each lamp, but reduce the light one-fourth.

Alderman Simpson said they had now had fresh instructions from the Commissioner of Police, which laid it down that they must have each lamp prepared for lighting in case of fog, and that in the side

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eets 75 per cent. of the lamps were to be lighted, instead of one-third now. The matter of the account had been before the Committee on great number of occasions, and they had done their best to get price of gas put on a proper footing. In the first instance, the counts were sent in and the Committee were told that the Brent- d Company made a reduction of 26 per cent., and the Richmond mpany of 24 per cent. The Committee thought that this was not great difference, and the accounts were passed. He admitted that Brentford Company's accounts were altered, and they allowed the uncil more discount; but there was not a great difference on the rcentage basis. The Committee, however, acted under a misap- hension. When the next quarter's accounts came in, they again k the percentage on the accounts submitted, and found that it s much less than the previous quarter; and, further, the amount of allowance varied very considerably—the Brentford Company allow- them 8s. 4d. per unlighted lamp, and the Richmond Company 2½d. The matter was referred to a Sub-Committee, and a deputa- n waited upon the Directors of the Richmond Company, in order to and come to some amicable arrangement to get the same reduction was allowed by the Brentford Company. The result of the deputa- n was a letter stating that the Company were willing to allow off the count for the past quarter for the lamps unlighted the same sum as Brentford Gas Company—8s. per lamp—and in future such allow- ces as were made from time to time by that Company. The Com- ny, however, refused to allow the amount on the previous quarter, they had paid their dividend, and could not re-open the matter. The t quarter's accounts came in; and the Committee found that the luction made was 4s. 9d. per lamp by each Company. The matter s referred back to the Sub-Committee, who went into the question ain and applied to the Gas Company to see how they made up their ures. The Brentford Company informed them that they made no arge for gas and allowed 4s. (as against 8s.) for maintenance, thus king a reduction of £1 7s. 2d. per annum.

After further discussion the amendment was lost, and the accounts ssed for payment.

GAS AND GAS-METER TESTING IN CANADA.

A Modification of Requirements.

Embodied in the report presented by the Executive Committee of Canadian Gas Association at the recent annual meeting in Montreal, s the text of a circular, dated July 8, establishing a new schedule fees for the verification of natural and manufactured gas-meters and nditions as to the calorific and purity tests of gas. These were alized by an Order in Council, on June 26, and abrogated Orders ued on May 12, 1905, and May 29, 1911. Some of the provisions certainly novel so far as English conditions are concerned; and ey may be of interest to many of our readers.

Verification of Tin Meters.

(Manufactured Gas.)

10 lights and under	$0·60
Over 10 lights up to 50 lights	1·00
Over 50 lights up to 100 lights	2·00
For every additional 20 lights or fraction thereof	0·50

Verification of Iron Meters.

(Natural Gas.)

No. 1 iron meter	$0·60
No. 2 ,,	1·00
No. 3 ,,	1·50
For each additional number	0·25
The fee for testing each proportional-flow meter—the owner to make the necessary connections, pay freight charges on testing apparatus, and travelling expenses of the inspector	10·00

Test of Calorific Power.

For each test of calorific power	$2·50

Purity Tests.

For each test as to the presence or absence of sulphuretted hydrogen if made at same time as calorific test	$0·25
For each separate or special test for sulphuretted hydrogen	1·00

Classification of Gas Companies.

The tests for calorific power shall be made in accordance with the number of meters in use, and at such times as are indicated in the following classification table:—

Class.	Number of Meters.	When Tests are to be Made.
1	Over 10,000	Daily except Sundays and holidays
2	5001 to 10,000	Three times weekly
3	2001 ,, 5,000	Twice weekly
4	1001 ,, 2,000	Weekly
5	1000 and under	Fortnightly

Certificates of calorific power tests are to be issued weekly to companies in Classes 1, 2, 3, and 4, and fortnightly to companies in Class 5.

Sulphuretted Hydrogen Tests.

Tests for the presence of sulphuretted hydrogen shall be made periodically as follows:

(*a*) Companies having more than 8000 meters, three times weekly. (*b*) Companies having less than 8000 and more than 4000 meters, twice weekly. (*c*) Companies having less than 4000 and more than 1000 meters, once each week. (*d*) Companies having less than 1000 meters, once fortnightly. Certificates showing the results of these tests shall be issued weekly to all companies except those coming under paragraph (*d*), in which case certificates are to be issued fortnightly.

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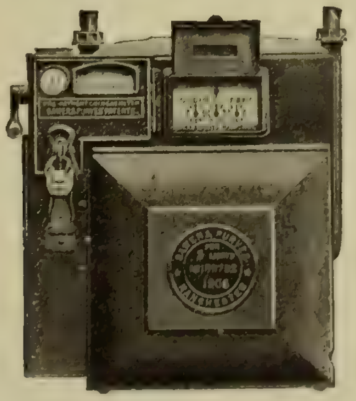

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THE POWER OF COAL GAS.

One of the items in an excellent syllabus arranged by the Shipley Branch of the Workers' Educational Association was a lecture on the "Power of Coal Gas," which was given at the Shipley Technical School on Thursday, the 14th inst., by Mr. Matt Dunn, M.I.Mech.E., the Engineer of the Stockton-on-Tees Gas-Works. Mr. H. Blakey, the Secretary and Manager of the Shipley Gas-Works, was stated to have been responsible for the giving of the lecture; but he had arranged for the attendance of Mr. Dunn to take his place.

Mr. Dunn stated that he had been for 34 years connected with gas manufacture; and though he had been learning all the time, he knew comparatively little about gas. It was an immense subject; and they were only on the threshold of gas uses. Some years ago, when electricity was introduced, it was stated that gas would be run out of the field; but the fear had been entirely unjustified, and there was a greater demand for gas to-day than ever in the history of its manufacture. There was no illuminant which was so effective in withdrawing foul air from a contaminated atmosphere. The moment the gas was lighted in a room, a mighty current was set up, which effected immediate ventilation of the room. This was impossible by electricity. Gas was the exact reproduction of sunlight. Gas-fires had the same cleansing effect as sunshine, and did not cause a heated atmosphere, but a pure radiant heat. There was nothing superior to gas as an illuminant, if it was properly regulated with an air-adjuster. Nearly all the complaints with regard to gas lighting were due to neglect of this principle. Proper combustion could only be obtained by adequate infusion of air with the gas. The heating value of the gas was, of course, most evident in cooking, heating, and driving. For cooking, electricity could not come into competition with gas, because gas almost at any price was cheaper than electricity for the purpose. A unit of electricity would give 3440 B.Th.U. of heat; but 7 cubic feet of gas would give 3700 B.Th.U. The 7 cubic feet of gas were equal to a unit of electricity for heating purposes. Suction gas would be produced at 4d. to 8d. per 1000 cubic feet; but its calorific value was so low that, by comparison with gas produced at the gas-works, it was dearer. Mr. Dunn gave instances of the value of gas for gas irons and radiators, which were more economical and effective than any other system. He said gas at 4s. per 1000 cubic feet was cheaper than electricity for most purposes. Alluding specially to gas-cookers, he stated that the highest efficiency in gas cooking could only be obtained by proper air-regulators. It was to be regretted that people who had to operate the cookers did not know how to make the best use of them; and even with gas-fires the cost was greater than it need be. Mr. Dunn expressed his conviction that water could be heated by gas for baths cheaper than by any other means.

There was a very good exhibition of gas appliances arranged by Mr. Blakey and Mr. Dunn; and the audience were greatly interested in the explanations given. Mr. Dunn was thanked for his lecture.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The Glasgow Corporation Gas Department arranged for an exhibition of gas-heated furnaces, which was open until the end of the week. It was made as representative as possible, so as to be of interest to all engaged in manufactures calling for furnace requirements, and particularly those on munition work. Many different types of furnaces were shown, including those for the heating of shell bodies and cases. Experts in the practical use of furnaces were in attendance to advise with respect to visitors' requirements; while practical demonstrations were also arranged for.

A settlement has been arrived at in an action brought by Alexander Nicol, of Edinburgh, against the North British Railway Company, for £500 damages in respect of personal injuries. It was stated by the pursuer that on March 6 last he entered the lavatory at the Craiglockhart Station, Edinburgh; and as it was dark, he struck a match with the intention of lighting the gas-jet. Immediately the match was lighted, a violent explosion took place; and he was knocked down and injured. Liability was denied by the defenders, who stated that they believed a prior occupant of the apartment had blown out the gas or turned it off and on again unknown to them. A payment has been made to the pursuer in full of his claim.

At the monthly meeting of the Coatbridge Gas Company last week, Mr. Alex. S. Legat, lately of the Carnbrae Iron-Works, was appointed Chairman of the Company, in room of the late Ex-Provost Sharp.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Oct.* 25.

Pitch continues without change; the position still being dominated by the question of freight. In other tar products, the position continues firm; the current values being: Creosote, 4¼d. per gallon, in bulk; solvent naphtha, 2s. 1d. per gallon, naked; 48-50 per cent. anthracene, 2¼d. per unit, casks free; 60's crude carbolic acid, 3s. 6d. per gallon for this year, and 3s. 4d. per gallon for next year, naked; pure toluol, 3s. 4½d. per gallon, naked—all at makers' works, net cash. There is, of course, not a free market in carbolic and toluol.

Sulphate of ammonia is in a strong position, and £14 15s. per ton, net and naked at makers' works, is reported as having been paid for 25 per cent. quality in large quantities over the next six months.

Tar Products in the Provinces.

Oct. 25.

There is practically no alteration in the markets for tar products. Business is still very quiet in pitch; and although quantities have been

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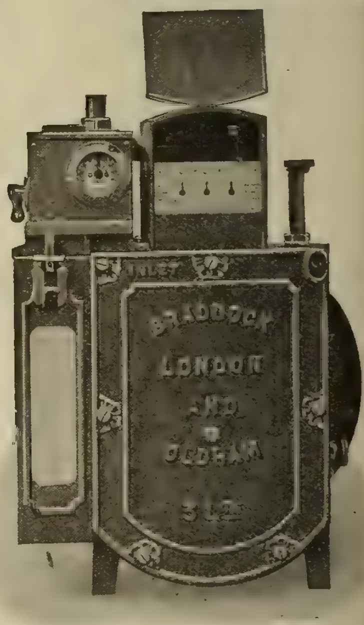

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ered at reasonable prices, no business of importance is reported.
eosote markets remain quiet. Solvent and heavy naphthas are in
od demand.

The average values of gas-works products during the past week
re: Gas-works coal tar, 19s. 9d. to 23s. 9d. Pitch, East Coast, 19s. to
. per ton; Norfolk, Suffolk, and Humber ports, 18s. to 19s.;
est Coast, 18s. to 19s. Manchester; 19s. to 20s. Liverpool;
. to 21s. Clyde. Benzol, 90 per cent., North, 10½d. to 11d.;
90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North,
2d. to 2s. 4d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d.
lvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha,
ked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅝d. to
Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included,
per cent., East and West Coasts, 3s. 5d. to 3s. 6d. Naphthalene,
8 to £28; salts, 75s. to 80s., bags included. Anthracene, "A"
ality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Oct.* 23.

Throughout the week the market for this material has continued very
n, and higher figures have again been paid at all the ports. There
been a distinct improvement in the foreign demand, and this has
led strength to the situation. The nearest values at the close are
5 2s. 6d. per ton f.o.b. Hull, £15 5s. f.o.b. Liverpool, and £15 7s. 6d.
b. Leith. In the forward position, a good volume of business has
been done, and transactions have been reported at £15 7s. 6d. per
f.o.b. Liverpool for November-December, and at £15 10s. f.o.b.
ith for January-June.

Nitrate of Soda.

This market is again firmer on spot, and prices have been advanced
4s. 4½d. per cwt. for ordinary quality, and 15s. 4½d. for refined.

Sulphate of Ammonia.

From another source it is stated that the market for this article has
ained very firm throughout the past week. Outside London,
kes are quoted at £14 15s.; Hull, £14 12s. 6d. to £14 15s.; Liver-
l, £14 15s. to £14 17s. 6d.; Leith, £14 17s. 6d. to £15; Middles-
ugh, £14 15s.

COAL TRADE REPORT.

thern Coal Trade.

There is a steady tone in the northern coal trade; and there is
much coal free for sale for the next fortnight's loading. Steamers
not now plentiful; and this keeps down the shipments, though
e heavy cargoes of coal are being sent to French ports. Steam
l is well taken up, and is about 19s. per ton f.o.b. for best North-
brians. Second-class steams are 17s. per ton; but where ready
oment is obtainable, slightly less may be taken in some cases.
am smalls are, on the whole, steadier; and from 11s. 6d. to 13s. 9d.
ton f.o.b. is the current quotation, according to the quality and the
e of loading. In the Durham coal trade, there have been some
siderable sales which have stiffened the market. Best Durham
coals are not plentiful, and command about 19s. per ton f.o.b. For
ond-class gas coals, the current quotation is from 16s. to 17s. per
. "Wear Specials" are scarce at 20s. 6d. to 21s. 6d. per ton f.o.b.;
the price is in degree defined by the time of loading possible. A
siderable tonnage of gas coal is being exported to the northern ports
France and to the Mediterranean; while there are tolerably full
veries on the long contracts for our own gas companies. The rates
reight are higher—that from the Tyne to London with gas coal is
n 9s. 6d. to 9s. 9d., and to Rouen up to 19s. has been paid. Ship-
is scarce; and thus the high prices are paid, though some steamers
carrying coal on contracts at lower rates. At some distant ports,
refore, our fuel is at high and irregular values. Coke is steady. Gas
e is quoted at stiff prices—about 30s. per ton f.o.b. being the current
tation for good makes in the Tyne. This contrasts with about half
t price a year ago; but both then and now the realized values to
producers were, and are, modified by the effect of the contracts at
ying prices running. At that time also, it should be remembered
t the market quotation for gas coal in Durham was probably 6s.
er than that which is now quoted.

Technical Instruction in the Gas Industry.—The report of the
ication Committee on technical instruction relating to the gas in-
try in the London area [*ante*, p. 103], in which it was stated that
ailed proposals for classes in gas-fitting for both junior and senior
dents will be considered in connection with the arrangements for
session 1915-16, has been formally received by the London County
ncil.

Bradford Municipal Water Supply.—The 1st inst. was the sixtieth
iversary of the taking over of the old Bradford Water-Works by the
nicipal authority; the transfer in 1855 having put an end to a great
ggle between the Corporation and the Water Company of that time.
posing Parliamentary Bills collapsed in 1853; and both parties
pared new schemes for submission to the next session. There was,
vever, a certain lack of enthusiasm in the Council, owing to another
ensive dispute; while in the Company there was a disposition to
ne to terms. Therefore, in March, 1854, the Corporation bound
mselves not to oppose the Company's Bill, and to take over their
nt, powers, and liabilities. The total cost of the transaction to the
poration was £237,965, of which £165,000 went to the Company,
o got what they asked for—namely, £40 for each £20 share. The
poration were also bound to carry out extensive construction works
Barden and Hewenden.

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Wexford Gas Price Raised.—The Wexford Gas Company have intimated to the Harbour Board that, owing to the higher prices of coal, they have been obliged to advance the charge for gas 2d. per 1000 cubic feet.

Dublin Gas Workers' Wages.—It is announced that the Alliance and Dublin Consumers' Gas Company have made advances in wages to their employees as follows: Stokers, 2s. 4d.; engine men, 3s.; water-gas makers, 2s. 4d.; machine men, 2s. 3d.; coal workers, 4s.; yard men, 2s.; boys under 18, 1s.

Excess Profits Tax.—In reference to the proposal to tax extra profits made during the war, Mr. Lough, in the House of Commons last Wednesday, asked "whether enterprises owned and carried on by municipal authorities of the nature of a trade or business will be liable to pay the proposed duty." Mr. M'Kenna's answer was in the affirmative.

Public Lighting of Maryport.—Considerable dissatisfaction has prevailed in Maryport owing to the policy of the Urban Council in keeping the streets in total darkness; and at the last meeting of the Council Mr. J. Dixon moved that half the lamps not coming under the Admiralty order be lighted. Mr. I. Hardy (Chairman of the Gas Committee) said their men had enlisted, and they had been replaced by inefficient men. The result was that the make of gas had fallen from 180,000 to 190,000 cubic feet per day to 130,000 cubic feet. They had not put up the price of gas, and they did not wish at this time, when the cost of living was rising, to still further reduce the value of the sovereign, though all through the country the price of gas had gone up. The first consideration for the Council must be the maintenance of a supply of gas for domestic purposes. The motion was defeated by 11 votes to 3.

Recruiting in a Gas-Works.—By invitation of Mr. George Clarry, Mr. W. T. Beavan, J.P., Lieutenant Henry Davies, Adjutant to the 2nd/5th Welsh Supernumerary Battalion, and Private Rossiter, from the Recruiting Office, appeared at the Cardiff Gas-Works early on Friday morning, and addressed a large body of workmen upon the pressing needs of the hour. For fully forty minutes the men stood silently listening to what was being said. Lieutenant Davies contrasted the labour conditions in Germany with those in Great Britain, and showed how much worse off British workers would be if ever they came under German rule. Mr. Beavan spoke of the necessity for sacrifice on the part of the employer and employee, if the war was to be carried through to a successful issue.

Ceara Gas Company, Limited—The annual general meeting of this Company will be held next Friday, when the Directors will present the accounts for the twelve months that ended June 30 last. The result of the year's working shows a loss of £2217, which, taken from the sum of £8083, the balance from last year, leaves £5866 to be carried forward. This result has been caused chiefly by the dislocation of business throughout the State of Ceará brought about by the war; while, in addition to this trouble, the State has been suffering from a very severe drought. Exchange is responsible for a loss of £2580. The Company has been most seriously inconvenienced by the non-payment of the public lighting accounts, which on June 30 were eleven months in arrear. During the year the Company paid heavily for coals and freight. Coal has now to be obtained in America, as the Government have prohibited export from this country. The Directors report the death of Mr. Cooper, who was Auditor to the Company from 1907. The Board appointed Mr. F. W. Church to audit the balance-sheet for the past year; but under the Articles of Association he is not eligible for re-election at the present meeting.

GAS COMPANIES IN THE STOCK EXCHANGE.

The improvement which was noted a week ago in the general position of things on the Stock Exchange was well maintained, and, indeed, in some lines advanced, in the week just closed. The cheerful tone which continued day after day bore witness to the confidence entertained in the markets. The pressure upon Serbia, and the differences of opinion indicated by the resignation of one important Minister in the British and another in the French Governments, could not shake the assurance felt in the House. Government issues were strong, and the War Loan steadily advanced. The result of the South African elections—which had been looked forward to with some anxiety—was a good factor. The splendid Canadian harvest, and the traffic statistics up to date, the improving condition of things in the South American States, and the more hopeful prospects in Mexico, were welcomed in the markets with rising prices. Japan also contributed to the advancing tide. In the Miscellaneous group, undertakings for the supply of the necessaries of war, and oils and rubbers, participated in the cheerful tone. Home Rails were almost alone in remaining outside the genial influence. The war-bonus concession made by the Government did not appear to make much impression; hopes being entertained that the Government would "stand the racket." But the ultimate position of the companies was a theme for grave reflection. Business in the Gas Market fell back again in point of volume, even after making allowance for a five-day week; and, in London, only five companies were dealt in at all. So far as business of such meagre proportions could afford any indication, the tone was firm and unchanged. Here and there a low price was accepted for an odd lot which had to be cleared. In the Money Market, the tendency was firmer. A considerable amount of gold was withdrawn for abroad. The question of the next War Loan was much discussed, and general expectation favours postponement till the New Year.

Bargains done for cash during the week were as follows: On Monday, British 35¾, Gas Light ordinary 78, 78¼, ditto preference 72½, 73, ditto debenture 62½, South Metropolitan 76, 76½. On Tuesday, British 35¾, 36, Gas Light ordinary 78, 78¼, 78½, ditto preference 73, Oriental 98. On Wednesday, Brentford "B" 86, Gas Light ordinary 78, 78½, 79, ditto debenture 62½, 62⅞, 63, South Metropolitan 76¼, 76½, 76¾, ditto debenture 60½, 60¾, 60⅞. On Thursday, Brentford "B" 86, Gas Light ordinary 78, 78¼, 79, ditto debenture 62½, 63, Liverpool 93½, South Metropolitan 77, ditto debenture 60⅞. On Friday, British 35⅝, 36, Gas Light ordinary 78, 79. The Exchange was closed on Saturday.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING OCT. 23.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.
£			p.c.				£ s. d.
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2
874,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5⅞—6⅜	5 17 8
50,030	10	Feb. 26	16	15/-	Bournemouth Gas and Water { 10 p.c.	29—30	5 6 8
873,480	10	"	7	7/-	B 7 p.c.	15—15½	4 10 4
95,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9
—	—	—	—	4	Deb.	..	—
880,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3
830,000	"	"	†11	55/-	Do. New	204—209	5 5 3
50,000	"	"	5	5	Do. 5 p.c. Pref.	109—111	4 10 1
206,250	"	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4
244,200	"	"	8	7¾	Do. A Ord. Stk.	154—159	5 0 8
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—
100,000	10	—	—	4 6	Do. 4½ p.c. Pref.	4—6	—
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11
1,513,280	Stk.	Feb. 12	5/9/4	49 4	Commercial 4 p.c. Stk.	106—108	5 1 2
560,000	"	"	5⅓	46/8	Do. 3½ p.c. do.	103—105	5 1 6
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11
800 000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3
200 000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8
—	—	—	—	11½	Croydon B and C 7 p.c.	..	—
4[illegible]2,270	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0
55,000	"	—	4	4	Do. Deb. Stk.	102—104	3 16 11
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1
16,362,910	Stk.	Feb. 12	4/17/4	4/-	Gas Light and Coke { 4 p.c. Ord.	98—102	4 15 6
2,600,000	"	"	3½	3½	3½ p.c. max.	76—79	4 8 7
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6
130,000	"	"	10	—	10 p.c. Bonds	..	—
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4
—	—	—	—	9½	Hornsey 7 p.c.	..	—
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C	151—154	5 2 4
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0
65,500	"	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. { A	211—213	4 13 11
718,100	"	"	7		B	146—14	4 14 7
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.
£			p.c.				£ s. d.
75,000	5	June 11	6	4/-	Malta & Mediterranean	4⅛—4⅝	6 9 9
250,000	100	April 1	4½	4½	Met. of Melbourne } 4½ p.c. Deb.	99—101	4 9 1
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼—7¾	6 9 0
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8
100,000	50	"	12	60/-	Do. C	118—121	4 19 2
52,000	50	"	10	—	Do. D	..	—
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 18 4
499,960	5	June 26	5	2/6	" 5 p.c. Pref.	4¾—5	5 0 0
521,600	100	June 2	4	4	" 4 p.c. Deb.	91—93	4 6 0
—	—	—	—	4	" " " 1911	..	—
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	5 9 1
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8
209,984	"	"	10	10	Do. B	222—224	4 9 8
523,500	"	"	10	10	Do. C	220—222	4 10 1
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5
60,000	"	"	5	5	Do. 5 p.c. Pref.	110—112	4 9 8
—	—	—	—	48/4	Do. West Kent.	..	—
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0
120,000	Stk.	Feb. 12	7½	7½	Tottenham District { A 5 p.c.	135—138	5 8 8
742,275	"	"	6	6	B 3½ p.c.	115—117	5 2 7
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 [illegible] 8
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4
					Wandsworth, Wimbledon, and Epsom—		
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2
108,075	"	"	5/17/3	55/1½	" C 3½ p.c.	110—115	5 2
352,000	"	"	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0
98,000	"	"	6⅝	63/9	Epsom 5 p.c.	121—126	5 5
88,416	"	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 1

*** For List of Lowest and Highest Prices of Bargains, see last paragraph of article above table.

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

North Warwickshire Water Company.

n the Companies Winding-up Court (Chancery Division), on Tues- last, the petition of the Coventry Corporation for a compulsory er to wind-up the North Warwickshire Water Company came before . Justice Astbury, when Mr. H. E. Wright said it had been arranged, ject to his Lordship's approval, that the petition should be dismissed hout costs. His Lordship assented, and the petition was dismissed hout costs.

Better Street Lighting Suggested for London.—In the course of a er to the Kensington Borough Council, pointing out the desirability securing greater uniformity of street lighting in the Metropolitan a, the Office of Works state that local authorities should endeavour obtain equality of lighting treatment, and excessive diminution of eet lighting was to be deprecated. The suggestion is made that 75 cent. of all lamps in side streets should be in lighting. The reduc- in main road lighting, it is pointed out, has in some instances been essive; and more lamps may be employed in such streets. All ps on street refuges could be in lighting without exception, provid- they were properly masked.

Trade Unionists Officials as Committeemen.—A resolution was ved by Mr. Leonard Foster (the Chairman of the Gas Committee), a meeting of the Sedgley Urban District Council, to the effect that, the opinion of the Council, it was undesirable and inexpedient that ember who was an official of a trade union whose operations might any time come into opposition with the Council's work should serve the Gas Committee." He referred, he said, to Mr. H. Hickman, o was on the Gas Committee and at the same time was Chairman the local branch of the Gas-Workers' Union. He charged Mr. ckman with causing discontent among the men who were engaged laying gas-mains. He desired an expression of opinion from the uncil in respect of the matter; and if he failed to get a favourable e, he should resign his position as Chairman of the Gas Committee. . Hickman said he had never sown seeds of discord among the rkers; and Mr. Foster had always had his loyal support on the Com- tee. Mr. J. T. Tennant (a former Chairman of the Gas Committee) gested that the resolution should be withdrawn; remarking that . Foster's purpose had been served, and it was now a matter for . Hickman's conscience. Mr. Foster agreed to this course.

Public Lighting of Holborn.—The Borough Surveyor of Holborn (Mr. E. F. Spurrell) reports that, under the terms of the public lighting contract, the Gas Light and Coke Company and the Metropolitan Electric Supply Company agreed to instal the new lighting system and supply illuminant, light, cleanse, extinguish, and maintain the whole of the lamps within the borough, and give an illuminating power of 424,140 candles, for a period of ten years, for the sum of £7645 per annum as from Jan. 1, 1913. Deductions or additions in the lighting units are charged or deducted at prices set forth in a schedule attached to the contract. To guard against air raids, the Council, at the request of the Government, materially reduced the lighting of the streets. The Electric Light Company could not see their way to make any monetary allowance; but the Gas Light and Coke Company, who supply gas to a large area, allowed the sum of £300 for the year under review. There are 966 electric and 878 gas lamps in the borough; the total candle power of the electric lamps being 194,450, and of the gas-lamps 233,300.

By a fire which broke out last Monday week at the Newquay Gas-Works, two engines were practically destroyed, and the engine-room gutted.

At the Dublin Southern Police Court, a youth aged 17 was fined 10s. for lighting public lamps before the hour at which they would have been lighted by the Corporation, thereby wasting gas the property of the Alliance and Dublin Consumers' Gas Company. Another boy of 13 was fined 2s. 6d. for a like offence.

British Dyes, Limited, have chosen a site at Huddersfield for the proposed new works, near to that occupied by Messrs. Read Holliday and Sons, whose works were purchased by the Company to form the nucleus of the larger concern. The whole new site occupies an area of 450 acres, 250 acres of which will be taken up by the works; the remainder being available for extensions, &c.

At a meeting of the General Purposes Committee of the Dewsbury Town Council, it was stated that arrangements had been made with the Huddersfield Corporation for a supply of water to the Ravensthorpe part of the borough, in case of necessity; and that satisfactory terms had also been arrived at with the Sheffield millowners, who have a claim upon the Water Board for a regular supply of water in the shape of compensation.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

pointments, &c., Vacant.

ngineer and Manager. Hebden Bridge Gas Board. Applications by Nov. 3.
ssistant (Montevideo Gas Company). Applications by Nov. 13.
harge of Gas Producing Plant. No. 828, c/o Robertson and Scott, Edinburgh.
orking Foreman. Hebden Bridge Gas Board. Applications by Oct. 30.
lerk. Reigate Gas Company.
esters (Gas-Fires, &c.). No. 6107.
itters. No. 6106.

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Meetings.

Ceará Gas Company. 9, Queen Street Place, E.C. Oct. 29, One o'clock.
Imperial Continental Gas Association. Cannon Street Hotel, Nov. 11, 2.30 o'clock.

Sales of Stocks and Shares.

Grays and Tilbury Gas Company. Tenders by Nov. 4.

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COPY FOR ADVERTISEMENTS for the "JOURNAL" should be ceived at the Office NOT LATER than TWELVE O'CLOCK NOON ON ONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVER- SEMENTS should be received by the FIRST POST on SATURDAY.

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Clauses and Precedents in

ELECTRICITY, GAS, & WATER LEGISLATION.

Being a Comparison of the Provisions contained in the Model Bills, in Special and Municipal Acts, and in Provisional Orders, 1910 to 1914, relating to these Public Services.

Compiled and noted by **JACQUES ABADY,** of the Middle Temple, Barrister-at-Law.

WALTER KING, "JOURNAL" OFFICES, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

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EDITORIAL NOTES.

Coal Owners' Interpretations, and Gas Companies' Protection Association.

OUTWARDLY, some of the coal owners appear to be acceptng with very ill-grace the interpretation put by the Board of Trade upon clause 1 of the Price of Coal (Limitation) Act; and seemingly there is in certain coal quarters a foolish eaning towards a desire to challenge the Board's view as o their own intentions. This was a matter that was dealt vith in the "JOURNAL" for the 5th ult. (pp. 13, 43). If the oal owners could be taken seriously, their position resolves tself into the opinion that Parliament has perpetrated a ery pretty fraud on buyers of coal by contract, and that the Act represents one of the best pieces of legislative travesty hat has ever found its way into the Statute Book. But vhether serious or not, those coal owners who have conended that the Act meant that payments for contract coal vere to be made on a foundation provided by the shifting rices day by day during the contract year ending June, 914, have made themselves look ridiculous by their attiude, and by the proposed application of methods that would ave done credit to a Shylock. And those who still persist n trying to urge any but the one sane construction of the Act are only heaping further ridicule on themselves. The natter was discussed at some length by Mr. H. E. Jones, he Chairman of the Gas Companies' Protection Associaion, at the meeting last Friday; and he did not hesitate to peak his mind. Mr. Hanbury Thomas, of Sheffield, also xpressed the view that the action of the coal owners was he "height of meanness." We agree, and at the same ime feel sure that those coal owners who desire (if there re really any such) to expose the incapacity of the Board f Trade to expound their own legislative productions would ndoubtedly find that their litigious escapade would successully prove their own stupidity. It will be noted by any of he owners who are desirous of putting the point to the test hat the Association are quite prepared to take up the matter n behalf of any of the subscribing undertakings. But we re not disposed to think that there are any coal owners so ereft of reason that they will be prepared to go the length f submitting the question to a Court of Law, especially fter the statement of the Board of Trade. Any communiation from a coal owner such as the one that was read at he meeting, and which was received by Mr. C. F. Botley, made subsequent to the ruling of the Board, ought to be eaded "bluff" in big capital letters. Coal owners have een convicted of having initially blundered in this matter f attempting to secure a monetary advantage by an evaion of the plain terms of the Act; and no one can think hat they want to encounter a worse fall.

There was a little discussion, at the meeting, regarding he work of the Association; and it was initiated by Mr. A. W. Oke. The Association has done yeoman service for he industry. The work that it does, however, cannot be udged by any single year, but only by the accumulation of he success it achieves, and the effort it puts forth. While vatching is incessant, opportunities for defensive endeavour ave to be taken as they arise. The Association cannot make he opportunities. When they do arise, the machinery is here to deal with matters, whatever their individual nature, f within the scope of the organization. A grand opportunity luring the past year was to render help in the Long Eaton ase; and Mr. Jones is proud of this piece of effective work n the interests of the whole gas industry, and incidentally n those of the electricity industry also, for it cannot be to ts interests to be pursuing business in an unlawful and inquitable manner. Testimony was borne by Mr. George Stevenson, the Engineer and Manager of the Long Eaton Gas Company, to the value of the existence of an organization hrough which it is possible to obtain the advice and experience of men in all walks in the industry when a matter of principle or policy, legislative or legal, is involved. But, on the other hand, Mr. Oke, who is one of the Directors of the Southampton Gas Company, had a complaint to make, to the effect that it is the considered opinion of the Company, and of certain others, that there is not enough energy shown by the Association in prosecuting its work.

It was a pity this complaint, if justified, did not come from a source other than one that felt aggrieved with the Association for not having taken action, at the request of the Company, in connection with a fight for the insertion of the Northumberland clause in an electricity measure promoted by the Corporation of Southampton. The Company were unsuccessful in their essay, up to the penultimate stage; and it was not till then that they solicited the aid of the Association. Without that aid, a partial success was achieved in the final stage of the contest. Mr. Jones stated the reasons for the non-intervention of the Association; and we think that, in this instance, they were good and sufficient. But it must not always be taken that the question of the financial position of a subscribing undertaking, or the fact that the undertaking has met with reverses, should rule whether or not the Association should lend its aid. The resources of the Association are not only of a financial order; we should be disposed to say its organized knowledge is of intrinsically greater value than its financial capacity. Mr. Stevenson, as we have already mentioned, found, in the litigation in which his Company were involved, the importance of the organization independent of its financial position. As to the Northumberland clause, it is doubtful whether the Association could have made out any better case than the Company did; and it is due to the Association to say that the established strength of the clause—subject to exceptional considerations, such as the Board of Trade and Parliament considered existed at Southampton in respect of the electricity supply in the borough itself—is largely due to the past action of the Association.

Then, as to the suggested instance that Mr. Oke gave of dereliction on the part of the Association, through the appearance among the miscellaneous provisions in the Model Clauses of one giving a conditional power to Directors interested in contracts to sit on a Board—a Board of any statutory company specially adopting the clause—we are afraid the Private Bill Authorities are not in the habit of consulting the Association, nor of following their advice, in the matter of provisions included in the Model Clauses. If they did, there would not be at the present time the very objectionable addendum to the model residuals clause which restricts to a one-third proportion of its own production the purchasing rights of an undertaking that has the complete model clause put upon it. But all undertakings are not treated so unfortunately. The Association has fought very strenuously over this residuals question; but all the same the partial restriction is in the Model Bill. We are not in sympathy with the clause to which Mr. Oke drew attention. But no blame can be imputed to the Association in respect of it; and when and how to raise objection to it, except privately, is a problem that is not easy of solution. No gas company need adopt the clause. It is not as Mr. Oke put it on the "Statute Book," except, it may be, through isolated Private Acts; and it is not a compulsory clause. Mr. Oke asked how long the Association were going to allow the clause to stay on the "Statute Book"? That was too great a poser for the Chairman; and he did not reply to it. Certain, however, it is that, if the Association had the power to abrogate the proceedings of the Private Bill Authorities, the clause would not for another day continue to bear the impress of their sanction.

Mr. Oke said what he did with all good intention, as he usually does; but he did not make out a strong case againts the Association on this occasion. He would like to see a little more energy put into the work. This shows that the matter has been under his consideration; and so if he will draw up a scheme with definite illustration, whereby the Association could expand in usefulness, it would be valuable to the Committee, and of interest generally to the subscribing gas companies.

Toluol.

There is an undercurrent of talk as to the possibility of developments in connection with toluol recovery, in which the gas industry will be largely concerned; and there is good authority for saying that the matter has been, and is being, seriously discussed. There was a further indication of it at the meeting of the Gas Companies' Protection Association. The Chairman (Mr. H. E. Jones) is also a member of the Munitions Committee; and he spoke, from his inner knowledge, as to the positive necessity of still further increasing supplies of the requisites for the making of explosives. He added that it might happen that gas undertakings would be asked to extend their work in this direction. If gas undertakings are required to go farther, it would be a *sine quâ non* that they should be relieved from all penalty testing for the time being; and that is a matter for the Government. Impossibilities cannot be done, though the utmost good will prevails; and there is a length to which gas undertakings can go in connection with the matter in question, and keep within the limits of their statutory prescriptions. But beyond they cannot proceed, and still be tied to compliance with the latter. In some districts, where prepayment consumers use a large proportion of flat-flame burners, there would be considerable trouble if the gas had its luminosity lowered too extensively, unless, of course, expense was incurred for enrichment, and that expense should not fall upon the undertakings. The business of the gas industry, too, would need protection against advantage being taken by competitors of the position created by rendering additional service to the country. Of course, all gas undertakings could circularize their consumers, and explain that what was being done was essential in the service of the country; and, in view of this, no doubt patriotic consumers would be tolerant. However, nothing definite has yet been done. The question is only at present under consideration. This being so, it is in the balance; and it may be that it will continue to repose there. If sufficient supplies can be obtained without the necessity arising for taking any further action, so much the better. Meanwhile, let apathy be voluntarily dissipated where it exists. Let the maximum production under present conditions be forthcoming from every undertaking. The war must be won; and high explosives are of paramount importance to that end.

Among the communications on the subject received by us in the course of the past week is one from a gentleman associated with certain works some of which are among those which may be classified as small. He puts a number of questions to us, which we may not at the present time reply to nor discuss. However, the whole of the information required can be obtained by communicating, either in writing to, or by personal interview at, the offices of the High Explosives Committee.

Advance Illustrated at Manchester.

The gas industry is ever in a state of internal unrest through development of its processes, new discoveries, and fresh applications of its products. Time was when some folk of mediocre perceptive power quite fancied that they had fully defined within their mental field of vision the whole horizon of the industry; but the last quarter of a century has shown how poor was their imagination, and how short their estimate of the wealth latent in the processes and products of the industry. It has during that period been a case of incessant forward movement—technically and commercially—until one can say, piecing together the contributory advance, that, in the main part of the manufacturing plant and methods, in relation also to the treatment of the bye-products (improvement of coke, the enrichment of tar, the protection of the ammoniacal liquor and the realization of a larger ammonia yield per ton of coal), as well as in the commercial business, mutation has been very complete.

Thoughts of the kind no doubt passed through the minds of some of the members of the Manchester Institution of Gas Engineers, as, with their President (Mr. J. G. Newbigging, the Chief Gas Engineer of the Manchester Corporation), they on Saturday inspected the extensive plant at the Bradford Road works. Mr. Newbigging is a technical progressive of the first water; and his engineering skill is seen throughout the works, especially in the masterpiece of the second largest gasholder—10 million cubic feet capacity—in the British Isles. What he has done, too, in the matter of the introduction of continuous carbonization in vertical retorts, and the success he has achieved therewith, are known throughout the profession. But Bradford Road to-day proves that he is not irrevocably tied to vertical retorts when engineering and other conditions make the continuance of horizontal working advisable. This is seen in the reconstruction, by Drakes Limited, of one of the large retort-houses at Bradford Road, on the horizontal system; the number of retorts involved being 260 of 22 feet long, ten in a setting, and worked by Fiddes-Aldridge machinery, electrically operated. In these few facts alone are embedded chapters of description of change that has so completely come over the constructional details and methods in the provision for, and operations of, coal carbonization. Economy in construction and labour is there; and a greatly enlarged output in relation to ground area, to capital involved, and to labour. Even in connection with such a detail as the hydraulic main, and the arrangements for the removal of the tar (by which the use of tar-pipes is obviated), change from the old order is seen.

Expansion and improvement in operations are also found independent of the primary process. Look at Cort's coke-cutting machines, Head, Wrightson, and Co.'s pan breeze washing plant, and Drakes' patent screening plant, which is novel in design and action, and (Mr. Newbigging thinks) is likely to be found very useful in gas-works—all are representative of auxiliary advances. Before the war there was some talk of action being taken by the gas industry to further develop within itself or upon its borders, through capital provided by men of the industry, the manufacture of sulphuric acid to a much greater extent than has hitherto been done. If this eventuates, it will be entirely the fault of the chemical manufacturers, owing to the aggressive attitude they took in Parliament towards the gas industry. The members of the Manchester Institution saw on Saturday the sulphuric acid plant that has been running at the Bradford Road works for a great number of years—a plant capable of producing 100 tons of chamber acid per week. In association with this plant, the visitors learned from Mr. Newbigging how it is proposed to enlarge the capacity by 15 to 20 per cent. simply by the introduction of Wyld's mechanical burners, in place of the burners now about worn out after thirteen years' service. In the system which Mr. Newbigging has decided to adopt, the oxide is drawn by means of a chain, with scrapers attached, through a two-shelf combustion chamber, with discharge of the burnt oxide at the front end of the burner. This is an item in improvement. But the latest development of all in gas-works is, of course, the almost general recovery of toluene. At the Bradford Road station, this work is going to be carried out on a large scale, and not by the "C" process, but by an oil-washing system. The plant is under construction at the present time, for the Government, by Simon-Carvès Limited; and it will be capable of treating some 8 million cubic feet of gas per day. The process is going to be carried out thoroughly, seeing that the gas, divided into two streams, is to travel through three scrubbers, and will require to be carburetted before being passed into the mains. In the descriptive pamphlet supplied to visitors, some interesting particulars are given as to the operation of the plant. In this work, there is for gas undertakings development, and in the development change. Another thing upon which there can be congratulation to Mr. Newbigging is the fine experimental plant he has erected at this station—a plant complete, and capable of an output of 60,000 cubic feet per day, with possible increase to 100,000 cubic feet. It is an experimental plant worthy the name. It is absurd to expect to ascertain all that a coal will do by working merely on the laboratory scale of 2·24 lbs. There is much more to be learned as to the most profitable treatment of a coal by a working-scale test in all its bearings in a plant of good capacity.

However, the Bradford Road works are illustrative of the vast change that has come over the engineering and other technical work of the industry; and a visit to them and the other stations of the Manchester Corporation Gas Department would assure our electrical friends who have placed a much magnified interpretation upon a few sentences in a certain British Association paper, that Mr. Newbigging holds very strong opinions as to the enormous place the gas industry is destined to fill in the life and progress of the United Kingdom.

Tar Developments Foreshadowed.

ffairs are moving fast in connection with the working-up f tar. It was not long ago—no longer than 1913, as witness ne of the Midland meetings that year—that the few gas ndertakings that were using tar-dehydration plants, in order cause their product to comply for road construction and praying with the Roads Board specifications, were looked pon as pioneers. Now, in connection with the tar-washing f gas and the recovery of toluol, tar dehydration, or the first age in the process of complete tar distillation, is beginning be regarded as quite the orthodox thing, and the forennner of larger developments in the direction of workingp tar by the actual producers. Indication regarding these evelopments—actual and possible—was given in the paper hich Mr. E. V. Chambers read on Saturday last before the lanchester Institution of Gas Engineers, and which paper both appropriate in time and of unusual interest, quite part from the incorporated description of Hird, Chambers, nd Hammond's dehydration plant, the hints as to proper ethods of working, the explanations as to how to secure el and heating economy, the quantities of products realizble from a ton of "average" tar (which will vary according the quality of the coal, and the system and the temperare of carbonization), the working costs per ton (which are ther on the low side compared with the actual costs with ertain known plants, and which costs must vary according local circumstances), and the profits per ton of tar treated which must also be qualified in the same way as the workg costs).

The author pointed out how completely events are fitting with the development of the working-up of tar—at any te, partially—by the simple dehydration plants now at ommand, and the installation of which is going on apace the gas industry. There has hitherto been enormous aste of valuable substances in the extensive application of rude tar to road surfaces; and yet the step between waste nd recovery was not a difficult one to take. But we have ow come to the parting of the ways between bad utilization nd good. The requirements of the war and of the country ave had a remarkable eye-opening effect. The very conituents of the tar that were detrimental for road purposes -the ammoniacal liquor, benzol, toluol, solvent naphtha, arbolic acid, and cresylic acid—are in most part the very nes that are wanted badly for both national and industrial urposes to-day, and will be permanently needed in large uantity after the war. Indeed, the developments in the ountry and generally, and the new conditions immediately ue to the war, will render the major part of the products ore valuable than ever. This being so, we have the first age in development, in the adoption of plants which will emove up to the phenols from crude tar. And a real ractical service is being rendered to the country by the nstallation where the tar is produced of these so-called ehydration or primary distillation plants; seeing that it is npossible for the tar distilleries, without outside aid, to eep pace with the urgent needs of the country for the very roducts of which the dehydration plants relieve the crude r, or the tar that has been enriched by gas washing. These roducts can then be sent (where the distillation is not arried forward to rectification and fractionation) for further eatment to the tar distillers, by whom also the dehydrated r will be dealt with in the usual way.

As previously mentioned, the dehydrating plant is merely e first unit of a complete tar-distillation plant for the roduction of naphtha, light oils, creosote oil, naphthalene, nthracene, and pitch. In other words, the adoption of the ehydrating plant means, for those gas-works producing tar nough, the entrance on quite new development. In such ases, and in those where it is not intended to go the hole length of distillation, but only one step farther, there ill be a passing next to the rectification and fractionation f the light oils obtained by the dehydration plant; and Mr. hambers considers that this will be profitable where the r dehydrated approaches 10 tons per day. The apparatus r the rectification and fractionation of the light oils is of imple character; and, like the dehydrating plants, can (the uthor says) be supervised by a man of ordinary intelligence. he paper supplies information regarding the approximate uantity of products obtained by the rectification and fraconation process.

This, however, leads up to a large and interesting queson. All gas-works are not of sufficient size individually to arry the process of tar treatment beyond the dehydration stage. This points to co-operative enterprise in this direction by groups of undertakings—a development that has been formerly hinted at in our columns when dealing with the opposition to the gas industry of the chemical manufacturers, and with the limitations that they sought to impose upon it. The matter of co-operative enterprise in connection with tar is not, however, being looked upon to-day in the nature of a reprisal, but as a very natural development, and one which has been quickened by the new conditions produced by the war. Such development would no doubt have come along anyway; but the tar-washing of gas, and the setting-up at several works of dehydration plants, have turned serious attention to the matter earlier than would probably have been the case otherwise. Mr. Chambers states that, in various parts of the country, gas engineers have under consideration the erection of central works on co-operative lines, whereby the light oils produced at several works will be forwarded to a central rectification plant, there to be rectified and converted into pure products for more immediate requirements. Such a central works would, of course, have complete commercial organization, with management, sales, and technical departments. This is not proposed as a temporary object, but something lasting, inasmuch as tar products, motor spirit, and the intermediate products required for the aniline and colour industries will after the war be in permanent request. There is no reason why such a central plant should not expand in service in the last-named direction. It is very satisfactory to learn that there are good grounds for anticipating that the scheme will materialize; so that the gas industry will be in the position to do a still larger share in protecting the country against the industrial and commercial sapping that had, before the war, set in with strength through the organization, enterprise, and finesse of our subtle enemies.

Flooding and Restoration of the Astoria Tunnel.

That wonderful piece of engineering conception and performance—the Astoria Tunnel, which connects, under the bed of the East River, the Astoria Works of the Consolidated Gas Company with New York City—has been the scene of some remarkable leakages and floodings, and of some skilful work in the attempt to combat the trouble—work interspersed with grave disappointment for the Engineers concerned: Mr. William H. Bradley, the Chief Engineer of the Consolidated Gas Company (whose scheme the tunnel was), Mr. W. Cullen Morris, the Constructional Engineer, and Mr. Harold Carpenter, the Resident Engineer. The engineering features and work associated with the tunnel were described in the "Journal" for Aug. 5, 1913. Soon after that publication, there came the deluge inside the tunnel, with its accompaniment of more difficulty—difficulty sharp, sinister, and complex—than was experienced during the actual construction of the great work. Mr. Harold Carpenter has prepared for the "Journal" an account, with illustrating it some telling photographs, of the several perverse happenings, and how they were ultimately conquered. There is large engineering interest in the record, with which British engineers will be pleased, and for which they will be grateful to the author, and to his Company for the permission to publish it. The trouble was due to a length of rock above the tunnel through which run seams of disintegrated material. In the building of the tunnel, this section of the rock, which was found water-bearing at high-pressure, occasioned unusual difficulty, and unusual methods had to be applied to overcome it. It was fully believed that the plans had been completely effectual; but unfortunately this did not prove true. It was eventually found that direct connection had opened up between the tunnel and the river bed; and evidence of this was seen in a curious assortment of débris littering the tunnel after the flooding was got well under. There was an unceasing struggle against the ugly but temporary adversity; there were many disappointments; but in the end engineering skill prevailed. After several attempts there was success with the grouting; but an immense quantity of material had to be used. And to make assurance doubly sure, in the trouble zone, the tunnel has now a cast-iron lining. It has been a big and a costly experience, which could not be avoided by the best of engineering talent and foresight. We congratulate the engineers on the success which has attended their contest with what was a real disaster upon what they had regarded as being the successful completion of a great and long contemplated scheme.

Showroom Reform.

Surprises are sprung on us. One came the other day. Mr. Cyril G. Davis has taken up his pen, and in an article in our columns he discusses well, and with the seriousness that a good cause deserves, the question of showroom reform. He has proved his capacity for discussing the question not by merely talking about it, but by getting those associated with him in business to give material proof to his views. Certain "salons" in Oxford Street have been the admiration of many men inside and outside the gas industry, and of all ranks. These show-rooms indicate certain things—that it is the view of Mr. Davis that gas demonstration must be lifted from drab and dreary surroundings, and that it must be on lines proving congruity for all purposes in the most elegant situations. Demonstrating this fitness, it is clear that gas can be applied in all places of less consequence. The "salons" testify the authority of our contributor to speak, and to advance his plea for show-room reform in the gas industry. There are in existence in the industry splendid showrooms which are examples of completeness; there are showrooms that are diametrically opposed to the description of "splendid." We have seen showrooms that would supply the nucleus for a gas museum; we have seen showrooms that, instead of being good advertisements for gas, are excellent advertisements for the competitor. Such showrooms say as plainly as they can—"This is something to be avoided." We have spoken with attendants in showrooms whose technical knowledge of the applications of gas, of the appliances shown, and of the capacities of those of their competitors, is about on a par with that of a native of Timbuktu. This should not be. Mr. Davis's plea is that the maximum power of the showroom should be developed by putting into it the maximum efficiency in attractiveness, in goods, in demonstration, and in attendants. The best ideals for a showroom cannot be in excess of requirements. The showroom has a creative part to take; but indifference in connection with it may make it destructive of an undertaking's interests. The time is not inopportune for the consideration of this question. If business is not quite so pressing now as normally, time can be spared for deliberation over showroom reformation. The commercial end of the gas business is the one from which maintenance of, and progress in, prosperity proceeds. What is done on the gas-works, in the matters of economical production and suitable quality, is essential to progress in prosperity, but the handling of affairs at the trading end has an importance of an order which is not always sufficiently appreciated.

The "Times Engineering Supplement" and "Total Heat."

In the "Engineering Supplement" of "The Times," an article is published on the institution of a universal calorific standard for gas supply in Canada; but there is an error in it which does a little injustice to the gas industry in this country. On a previous occasion, we called attention to the legislative knowledge of the writer of the gas contributions to the "Engineering Supplement" being somewhat behind, in a certain particular, the actual position. It is so again. He says that the Canadian standard is fixed at 520 B.Th.U., with no margin for default; but "the most interesting and gratifying stipulation is that providing for the use of a *total heat* calorimeter for performing the test. Thus the 520 B.Th.U. standard differs entirely from those hitherto adopted in this country, where either 'gross' or 'net' values have been assigned." It is clear the author of this statement has never heard that in the Gas Light Act, 1914, the following provision appears: "The apparatus to be prescribed by the Gas Referees for testing the calorific power of the gas supplied by the Company shall be the most suitable for ascertaining, and in making the test shall be used in such a manner, and under such conditions, as to ascertain, after any necessary calculations have been made, the *total heat* value of the gas." The Liverpool Company and all the companies in Parliament in the session of 1914 who asked for a calorific standard are under the total heat test; and those who were in Parliament this year have come under the model clause, which provides that the prescriptions of the Metropolitan Gas Referees are to apply. These prescriptions are modelled on the Gas Light calorific clause of 1914, providing for "total heat" testing. Of course, various undertakings have now a marginless clause, providing for 500 B.Th.U. (total heat). We see there is a misprint in the fourth paragraph of the article in the "Engineering Supplement" in referring to the Canadian standard as being of 540 B.Th.U.; but the correct figure—520 B.Th.U.—is stated earlier in the article. The writer in our morning contemporary agrees with the view expressed in the editorial columns of the "JOURNAL" for Sept. 7 as to the basis for penalties for default in the Canadian calorific regulations not being quite satisfactory.

The British and Neutral Flags.

In an article in the "JOURNAL" for July 6 last, the question of northern coal deliveries and exports last winter was dealt with. While London and many other parts of the country were then being starved for coal, or could only procure supplies at extortionate prices, it was stated, on authority of actual eye-witnesses, that the number of ships laden with coal and sailing to the ports of neutral countries under neutral flags had considerably increased, compared with corresponding months of previous years; and there was excellent ground for saying that some of these ships were engaged in supplying enemy countries. It was a very great mortification to those representatives of large purchasers of gas coals to see this while themselves waiting for supplies, and impotent in the matter of doing anything to remedy the conditions. And this was going on under the very noses of the authorities. However, the Exports Regulation Committee was established, and affairs improved. Now Article 57 of the "Declaration of London" has been abrogated by an Order in Council. Under the article, the enemy or neutral character of a vessel was determined by the flag she was entitled to fly. Flags are not expensive things when enemy traders want to delude a country, the Government of which has proved itself most tolerant in respect of subterfuge on the part of the enemy. The enemy, the Government have now realized, has been flying neutral and even British flags in order to hoodwink them, and to continue to trade; but in future the character of a vessel is to be judged not by a flag, but by the nationality of the owners. Still metamorphosis is not without place in Teutonic Kultur.

Training Scheme for Gas Engineers.

An interesting letter appears in our "Correspondence" columns from Mr. Thomas Glover, of Norwich, touching the question raised by Mr. David Fulton, in his Presidential Address to the Western District of the Glasgow Junior Association [*ante*, pp. 178, 203], as to the provision of a directive scheme of training for young men aspiring to chief technical and managerial position in the industry. Mr. Glover speaks from experience as former Examiner in "Gas Engineering" for the City and Guilds of London Institute; but his letter does not supply exactly what Mr. Fulton and others desire, though it does give a foundation upon which a more detailed and helpful training scheme might be built. Mr. Glover has detected serious defects in the knowledge of many candidates for examination; and what he said in his report for 1912, and says again now, is confirmation of the lack of any systematic training effort—that is to say, for young men who are unable, through uncontrollable circumstances, to take a special course at one of the Universities or Scientific and Technical Colleges before being articled to a gas engineer. What he found is that many of the candidates have had a one-sided training—they may possess a good knowledge of chemistry and a poor knowledge of engineering, or *vice versâ*, which will not do for a man hoping to occupy a position requiring a really sound knowledge of mechanical and constructional engineering and chemistry, as well as having good managerial capacity.

Enhancing the Value of the Examinations.

Mr. Glover's simple and (if adopted) effective scheme for improving matters (though it does not go so far as Mr. Fulton would like and as Mr. F. J. Bywater urged in the early part of last year) is that, before candidates for the "Gas Engineering" examination are allowed to sit and obtain a certificate, they should be required to pass a preliminary examination in chemistry and mechanical engineering. This would help to weed out the ineligibles for the "Gas Engineering" examination; and the improving effects would be: (1) To increase the usefulness of the latter examination; (2) to enhance the value of the "Gas Engineering" certificate; and (3) to safeguard worthy candidates from being placed on a no higher level than those whose training has been of an indifferent order. At the present time, the certificate is not all that it should be to the possessor, as a gas engineer looking out for an assistant knows full well that many quick-witted, but improperly trained, ellows have been able to get through the examination by answerig the stipulated number of questions, and obtaining the stipuated number of marks, although without the practical training nd experience possessed by other successful students. The ace value of the certificate secured by the one is equal to that warded to the other; the intrinsic value of the two men, for fficial position on the technical side of the industry, is far from being the same. Mr. Glover's idea would do something to prevent this injustice and depreciation of the value of the certificate. Perhaps our correspondent can move not only in attempting to appreciate the value of the "Gas Engineering" examinations, but in getting that directive scheme for students which Mr. Bywater and now Mr. Fulton have urged should be provided—say, through the media suggested in the editorial columns last week.

THE LATE PROFESSOR LEWES.

It is felt that to the readers of the "Journal" the accompanying photograph of the late Professor Vivian B. Lewes will form a valued supplement to the obituary notice which unhappily fell to be inserted in the last issue. As was then stated, Professor Lewes was in his 64th year when he died; and his life from early times had been an extremely active one.

[Photo. by Elliott and Fry.

By way of addition to the partiulars already given, it may be tated that the first part of his ducation was received in Univerity College School, and afterwards n University College, London. When he had reached the age of 16 Mr. Lewes [as he then, of course, was] became assistant to the late Professor F. Barff, the originator of he Bower-Barff process for proecting iron from rusting. Then, n 1870, he went to the Birkbeck Laboratory, as assistant to Proessor A. W. Williamson, who was t that period Chief Metropolitan Gas Examiner. For some time he ad charge of the Birkbeck Laboraory, while under the direction of Dr. Charles Graham; and eventully he became Manager to Proessor Williamson, in connection with his experimental works at Willesden. Professor Lewes's long onnection with the Royal Naval College, Greenwich, began in 1879, when he joined the staff; and within welve months of this time he was elected as Gas Examiner at the Cloth Fair testing-station of the City of London. He became Proessor of Chemistry at the Royal Naval College in 1888, and Chief Corporation of London Gas Examiner four years later.

Professor Lewes's extensive reearches in connection with acetyene began about the year 1894, when he received some calcium carbide from the United States. A ong series of experiments was at nce started by him, as the outcome of which he exhibited acetyene as an illuminant before the Society of Arts quite early in he following year. Looking over some back volumes of the "Journal," among the innumerable reports of papers read, ectures delivered, and patents taken out, one finds mention of many marks of appreciation of his work which were bestowed upon the Professor. To mention some, he was presented with medals by the Gas Institute, the Institute of Naval Architects, he Society of Arts (on several occasions), and the Society of Engineers. It is pointed out by the "Journal of the Royal Society of Arts," in enumerating some of Professor Lewes's lectures, that e made no fewer than sixty appearances on the platform of heir great room; "and in this respect he very easily holds the ecord. His lectures were invariably well attended, frequently rowded. He was undoubtedly a very attractive lecturer. He poke with a fluency that astonished strangers; and he never had ccasion to use a single note." His position at the Royal Naval College he held until last year, when he was succeeded by Mr. J. S. S. Brame, who was for a long period his assistant.

As mentioned last week, Professor Lewes was in 1903 made an honorary member of the Institution of Gas Engineers. This was at the time of the Incorporation, when the Council, under the new rules of the Institution, nominated five honorary members. The other four gentlemen so named—by all of whom Professor Lewes was predeceased—were Sir George Livesey, Mr. Thomas Fletcher, Mr. Joseph Hepworth, and Mr. George Bray.

Writing under "Motoring Notes and News" in "Sporting Life," E. N. D. says:

> The more advanced motorists throughout the Empire will hear with real regret of the death of Professor Vivian B. Lewes, F.I.C., F.C S., from pneumonia. Though he consistently avoided publicity, Professor Lewes's eminence in chemistry (and particularly the chemistry of gases and gas-engines, stationary or mobile), secured to him the respect of motor engineering students all over the world; and his personality was such that all who came in contact with it remained his friends no less than his admirers. The professor was best known to the general public as a lecturer who could teach science in language understanded of the people. No matter how advanced his subject, his diction was always that rather of a cheery man of the world than a distinguished scientist; and one of his firmest convictions was that it was neither necessary for a clever man to be high-falutin', nor for an admitted master of a subject to imagine that he, and he alone, knew all there was to know about it. As Professor of Chemistry to the Royal Naval College, Greenwich, the deceased gentleman had through his hands all the naval officers going afloat in the past twenty years, and was equally at home in the chemistry of explosives, liquid fuels, protectives for ships' bottoms, or the bluejacket's tot of rum. It was possibly his constant association with naval officers of all stages of evolution which made Professor Lewes so human a soul, so unlike the accepted idea of what is professorial.

The Funeral.

After cremation at Golders Green, the funeral took place last Wednesday at the cemetery attached to the Royal Naval College, Greenwich. Among those present were Lieutenant Edward Lewes (son), who supported Mrs. Lewes; Rear-Admiral Jervoise, Professor J. S. S. Brame, and a number of members of the staff of the Naval College; Sir Boverton Redwood, who represented the Royal Society of Arts, the Chemical Society, the Institute of Chemistry, and the Institution of Petroleum Technologists; Mr. W. W. Duffield, who has been appointed Superintending Gas Examiner to the Corporation of London *pro tem.*; Dr. Fison, the Secretary to the Gilchrist Educational Trust; Mr. Thomas Goulden (Chief Engineer to the Gas Light and Coke Company), Mr. F. Baily (of the South Metropolitan Gas Company), Mr. H. F. Hills (Chemist to the Commercial Gas Company), Mr. Carl Dellwik, Chief Petty Officer W. J. Liberty (City Lighting Inspector), and Mr. George Lorimer. Mention, too, must not be omitted of the presence of the Professor's old assistant "Joe," who used to look after the apparatus, &c., on the platform, and so was well known by sight to those in the habit of attending the lectures.

Painting by Immersion and by Compressed Air.—This is the itle of a practical handbook [a copy of which has been received rom the offices of the "Managing Engineer," Nos. 93 and 94, Chancery Lane, W.C.], by Mr. A. Seymour Jennings, F.I.B.D., the Editor of the "Decorator," and author of various works connected with painting. The matter is accompanied by 150 illustrations; and as it is claimed to be the only book on the subject with which it treats, it should be widely useful, for the information given concerns a great number of industries. Painting by spraying, it need hardly be pointed out, is useful for the maintenance of large structures like holders on gas-works, as well as in the application of lacquers, varnishes, &c., to smaller appliances, and of lime and whitewash to walls. In fact, the illustrations show, among many other things, an "Aerograph" machine painting a gasholder, and "Airostyle" installations working on gas-fires and gas-meters. The price of the book is 10s. 6d. net.

PERSONAL.

Mr. W. W. **Duffield** has been appointed to succeed *pro tem.* the late Professor Vivian B. Lewes in his work as Chief Gas Examiner to the Corporation of London.

Mr. J. **Fazakerley** has resigned the post of Gas and Water Engineer to the Goole Urban District Council; and the Council are proposing to appoint a successor at a salary of £300 a year.

For some few weeks, information has been circulating among the friends of Mr. **Charles Carpenter**, D.Sc., the Chairman of the South Metropolitan Gas Company, as to his progress in connection with an operation (fortunately not of a serious nature) which he has recently undergone. It was the pleasure of Mr. H. E. Jones, in his address at the meeting of the Gas Companies' Protection Association last Friday, to make reference to the fact that Mr. Carpenter has left London, and is recuperating at Hindhead, with confidence that his usual activities in connection with the South Metropolitan Company and the gas industry generally will now be quickly renewed. The intelligence will give gratification to a large number of readers, who will join with us in congratulating Mr. Carpenter upon a speedy recovery.

A Memoir of James Robson.

A memoir of the late James Robson, whose death occurred at Handsworth last August [as briefly recorded in the "Journal" at the time], has been carefully prepared by his son, Mr. James Robson, and printed with a number of illustrations, for the loan of some of which indebtedness is acknowledged to Messrs. Tangyes Limited. Both descriptive matter and blocks are of a character which gives to the memoir more than a personal interest; and we are asked to state that Mr. Robson [whose address is Pendennis, Sandwell Road, Handsworth, near Birmingham] will be pleased to supply copies, free of charge, to engineering professors and consulting engineers, as well as to the principals or librarians of technical schools, who care to apply to him. In a preface, the author says that, at the request of many friends, he has written this brief history of the work of his father, "in order that the honour, which is his due, may be given to him for his untiring energies and his work in connection with the development of the internal-combustion engine." He continues: "Owing to a great natural dislike to having his name brought prominently before the public, my father remained very much in obscurity throughout his lifetime; and therefore his experiments and his work have hitherto remained unrecorded. The fact that my father was the first and true inventor of the 'two-cycle' gas-engine is, therefore, probably not so widely known as it should be. By the term 'two-cycle,' I mean that cycle in which all the operations of charging, compressing, igniting, combustion, and exhausting are performed in a single cylinder having a single piston, and in one revolution of the crank-shaft [or a complete to-and-fro movement of the piston itself in the engine cylinder], without the addition or assistance of any pump or other contrivance." Mr. Robson expresses the hope that the memoir will be welcomed as a small contribution to the history of the development of the British internal combustion engine. Reference is also made to the invention by his father of the gas forging hammer.

The Coke-Oven Manufacturers' Association.

Referring to the rules adopted at the Inaugural Meeting of the Association recently held in Sheffield [as reported in the "Journal" for Sept. 28, p. 692], the "Iron and Coal Trades Review" says: "The Committee have laid down the qualifications for membership in a very precise and definite manner. This, we think, in the best interests of the Association, is in every way desirable; it cannot be too exclusive to serve its most useful purpose. Of course, the gas-works have their own Association, which has done, and is still doing, very excellent work; but to avoid confusion of issues, it is imperative that the Association of Coke-Oven Managers should be kept entirely distinct, for, though sister industries, they have, at present at any rate, very little in common. Obviously the first objective of the gas-works manager is the production of the largest possible volume of gas of a standard calorific value from a given quantity of fuel. Coke with him is an incidental to that production; and, except in the case of the larger undertakings, the bye-products are dealt with by a separate and independent works. It is true bye-product ovens are coming into favour at the gas-works; but even so the coke made must always be the second consideration. The coke-works manager, on the other hand, must stand or fall by the quality of his coke; and with the exception of those isolated cases where the gases evolved, or certain proportions of them, are disposed of for lighting or power purposes, he is not called upon to closely study calorific values. His one concern is the recovery of the bye-products from the gas, and to see to it that nothing, the recovery of which is commercially practicable, is sent to the boilers or back to the ovens. In this connection, he must continue his processes to a point which would be neither commercial nor practical at the gas-works." It may be added that the first general meeting of the Association will be held in the Mappin Hall, Sheffield, on the 13th inst., when the President (Mr. George Chrisp) will deliver an address entitled "Notes on the Development of the Bye-Product Industry of Great Britain."

ELECTRICITY SUPPLY MEMORANDA.

Street Illumination.

It is learned from our esteemed contemporary, the "Electrician," that "the question of the illumination of streets," which was marked by somewhat heated discussion in this country two years ago, *seems* now to be receiving less attention." As, after dusk, we look out into —— Court and —— Street, there is at first a disposition to agree with our contemporary, excepting in respect of the doubt that the word "seems" implies. But upon further consideration, we are convinced that the "illumination" of our streets is receiving a good deal of attention. The Admiralty, the Home Office, those who wander by night in the space above us, the police, and the gas and the electricity suppliers are all engrossed by the subject, and have done their best, in a good cause, to make lamps look as hideous as possible, and the streets as dark as possible by putting some lamps out of action, eliminating upward rays, and deadening downward and horizontal ones. Municipal authorities are also concerning themselves in the matter, as, where they buy the illuminating agent from a company, they find a reduction of street lighting an excellent way of economizing, and diminishing expenditure. However, in respect of normal street illumination, the "Electrician" discovers interest in a paper by Mr. T. S. Millar, which has engaged the attention of the American Institute of Electrical Engineers. The paper covers many considerations affecting street lighting; but the three that have the freshest appearance, and which are usually neglected in discussion, are the silhouette effect, the specular effect, and glare. We cannot be charged with having kept the last-named in the background.

The Silhouette Effect.

Now that Mr. Millar calls attention to this matter, we appreciate its importance. Black patches, however ornamental the edges, with a white background, have never appealed to us as being either useful or pretty. But that the condition is a practical consideration in visibility at night time is apparent now that attention is drawn to it. Unconsciously we have all been making use of the silhouette effect at night time; and the fact is appreciated after reading the paper. The difficulty will be to get the general public to know that they have been doing the same thing; and another trouble will be to get the lighting authorities to understand that it is their duty, in order to assist street traffic at night time, to scheme their public lighting installations so that the silhouette effect is deepened, by keeping objects as dark as possible, with a good light background. One way of doing this would be to have all objects painted dead-black, and all people dressed in black, and so looking as uniformly mournful as possible. Then, of course, to prevent the upsetting of our mental equilibrium by the lugubrious conditions, we should all stay at home at night time. However, it is easy to see what Mr. Millar is driving at, and the lesson he seeks to impress, by an experiment he made. Six test targets were set up successively between the street-lamps. Why describe them as targets, when nothing was thrown or shot at them? These were substantially the same colour as the street surface. Those which were most clearly revealed—this is important—were those which received least light, and were silhouetted against their background. Those less distinctly revealed received on the observed surface about the same light as their background. This appears to us to be a good argument against the employment of light sources of too high power, because the closer an object approaches a high-power lamp, and receives greater illumination on its surface, the less visible it becomes. To intensify contrasts on surfaces is to better conditions for vision. It is clear that those responsible for street illumination must revise some of their ideas on the subject, and discontinue chaining themselves up to the notion that curves of illumination intensity form the most appropriate basis for judgment as to effectiveness.

The Specular Effect.

Blessed be automobile traffic; for the street pavements, through the dropping of oil, and the polishing effect of the tyres, are becoming bright and glistening, and this, we find, is a consideration in modern street illumination. It is probably all right in dry weather; but we get a good proportion of rain in this country, and do not like on our habiliments splashings of mud one of the ingredients of which is oil. The speckled effect on our clothes concerns us much more than the specular effect produced by the polished surface of the roadway. However, Mr. Millar presents evidence (which we should like to see substantiated by other observers) that the specular effect produced by the oiling and polishing of the road surfaces by motor cars is an extraordinary factor in street illumination. He cites one street in which the automobile traffic forms but a slight part of the whole, and in which the foot-candles vary in the ratio of 46 to 1, while the brightness varies in the ratio of 8 to 1. But in another street which is traversed largely by automobiles, the horizontal foot-candles vary in the ratio of 10 to 1; but the effective brightness varies in the ratio of only 2 to 1. On which Mr. Millar observes: "The impression of uniformity which one derives from a trip through this street is expressed by the brightness ratio rather than by the foot-candle ratio." He adds that the street surface consists largely of small polished areas which eflect specularly; and, in driving through the street, one sees reected in these small polished areas, the imperfect images or part nages of distant lamps. Another observation is that recognition f the fact that modern streets are likely to be criticized by, more r less, this specular quality, necessitates important alterations n some of the theories regarding street lighting which have preailed in the past, and which are held at the present time by some ngineers. As an aid to street illumination, road authorities had etter, in order to secure a good supply of specular effect, start iling and polishing the street surfaces, and not leave it to the dventitious performances of motor cars. As there is a shortness f men, those local councillors who are no good for administrative urposes, might, in the public interest, take this work in hand hemselves.

The Glare.

It is easy to agree with Mr. Millar that glare militates against good street illumination—first, by diminishing the ability to ee, and secondly by rendering unpleasant the installation and the treet. Anything which reduces the contrast between the light ource and the road surface, or which increases the illuminated rea within view, or which separates the bright light source from he road surface, reduces the effect of glare. It has been found hat a large reduction in visual power can be traced to the preence of a bright light source close to the centre of the field of ision. This being so, what is the good of a bright light source? f vision is going to be reduced by its presence, the excessively right light source is a nuisance and a waste. However, Mr. Iillar suggests that what has to be done is to reduce the contrast etween the light source and the illuminated surface; and that a onstructive way of attaining the desired end is to increase the rightness of the illuminated surface rather than to dim the lightource unduly. But at the same time he admits that excessive rightness (or glare) of light sources must be reduced, and this at ll angles coming within the range of the eyes. The double duty -the diminution of glare, and increasing the brightness of street urfaces, and, where desirable, that of the surroundings—in the uthor's opinion can best be accomplished by the use of diffusing lass accessories. The method of illumination that gives the east glare and the best diffusion without auxiliary aid is the inandescent gas-light.

Needy Municipal Electricity Concerns.

"Electrical Engineering" has been giving a little advice to municipal owners of electric supply concerns, as to how they should conduct their business in respect f charges to private consumers in these times of heavy costs. he whole tenour of the article points to the private electricity onsumer being a very delicate and sensitive person, whose pocket must not be tampered with more than is really unavoidable, in ase he shuffles off the electrical coils, and returns to the hated val. The private electricity consumer must be studied by those uppliers in a position to study him. The undertakings that can nd are doing so, we understand from our contemporary, are the arge municipal ones with reserve funds upon which to fall back n these days of stress; and their financial stability is such that hey are able to continue on the old tariffs. There are not many oncerns in so fortunate a position. But it is not to them "Electrical Engineering" addresses itself. It is to those smaller underakings that have wickedly been bye-passing the reserve fund, and ontributing money to the rates. Of course—though our contemorary has accidentally forgotten to mention the matter—there re electrical undertakings that are incapable of contributing not nly to a reserve fund, but to the rates; and there are some electricity concerns that dip into the pockets of non-consumers of lectricity in order to make up the expenses incurred in the supply f those who are consumers, which is a form of robbery with violence which is not to the credit of municipal administration. But what is the good of preaching to those concerns that are to-day uite destitute of reserve funds? If they either did not or could ot provide them in the past, they certainly will not be able to lo so now that costs have gone up so steeply, and promise for ong to remain on a higher scale than formerly. Our contemporary's lecture is somewhat belated. It might in the present do omething better, in the cause of justice, by urging those municipal concerns that have been habitual plunderers of the rateayers in order to maintain the old tariffs to consumers, to put pon the consumers, and not upon the ill-treated ratepayers, the dditional costs occasioned by the war. Then, in connection with eduction of public lighting, and the saving thereby effected, our contemporary shows a peculiar twist of mind. Everything must be or the benefit of the electricity concern and the private consumer, nd not for the heavily taxed ratepayer. The paper asks a question, to which it is patent an answer in the affirmative is required. "Seeing that the general body of ratepayers presumably benefit rom the reduced cost of public lighting, should the loss in revenue o the supply department be made up wholly by increasing the charge to the consumer of electricity for other purposes?" This s amusing. There are not many municipally owned electricity concerns that are making a reduction in charge for public lighting; those that are, only do so to the extent of the current unconsumed. So that on balance, from public lighting—in view of the charges made, and inasmuch as some of the hours of use for public lighting come on the peak—there cannot be much loss to the revenue. If the suggestion were logically pursued, it might be asked: As tradesmen benefit by reduced electricity accounts through the lowering of their shop illumination, "should the loss in the revenue to the supply department be made up wholly by increasing the charge to the consumer of electricity for other purposes?" We cannot for the life of us see why the ratepayers (*quâ* ratepayers) should pay for electricity they do not consume any more than any other customer of the undertaking. We are not believers in relieving the rates out of municipal trading profits; and we are not believers in relieving consumers at the expense of the ratepayers. The act is a vicious one, the equal of which is not to be found, and would not be tolerated, in private enterprise.

Water Heating.

An article recently appeared in the "Electrical Review" beating-up that slow moving hope of a few electricians—the realization of a practicable system of water heating which will enable the dear B.Th.U. of electricity to do for the consumer what the cheap B.Th.U. of gas accomplish. There has been no success yet, nor is there likely to be; for no one, except an electrical enthusiast, could put up with the limitations of water heating by electricity—in regard to cost, and quantity in relation to time. The writer of the article referred to is pleased, in the interests of the electric water-heating branch, to see current dispensed at ½d. per unit. But he insists on adding "or less;" and, in order to save himself from attack, he incidentally mentions that there is a fixed charge which has to be shouldered either by one purpose for which the current is used, or proportionately by the whole of the purposes. Well, now, using current at ½d. per unit, he avers that there are many cases in which electric heating of water in bulk will show distinct economy over any other system. We should like to know something more of these cases—something more of the money and the time economy, and the relative positions of electricity and gas as *ad lib.* suppliers of hot water. The article does not give any figures from practical experience and tests with modern apparatus—everything is calculated on theoretical lines. The writer describes the Rittershaussen thermal storage arrangement, the distinctive features of which are an immersion heater and an enclosed hot water delivery-pipe. He awards to this apparatus an efficiency of 90 to 95 per cent.; but it appears that it takes about half a day to heat the whole volume of water in the storage tank to a temperature in the neighbourhood of 200° Fahr. Slow heating of this kind with the storage-vessel thickly lagged will not prevent continuous heat leakage; and we much question the efficiency mentioned. With the quick heating of water (as required) by means of gas, the loss is not nearly so great as with slow heating and long storage before use—of course, in all cases loss has some relation to the temperature of the atmosphere in the neighbourhood of the storage tank. The writer only gives a 50 per cent. efficiency to a gas water-heater. We have so many water heating methods in the gas industry that we should like to know which one is referred to by him; seeing that 50 per cent. efficiency falls far short of the actual with some gas-heated boilers and geysers. Taking electricity at ½d. and gas at 2s. 6d., and the efficiencies named, the writer finds the cost of 1000 B.Th.U. with electricity would be 0·16d. and with gas 0·09d. We will not put these figures to any critical examination—in the first place, because we know of better efficiencies with gas than the one taken, and lower efficiencies than 90 to 95 per cent. for electric water-heaters. As, too, it requires a good many 1000 B.Th.U. to heat a large volume of water from (say) 46° to 212° Fahr., and as large volumes of hot water are frequently required in a well-ordered household for bath purposes, even a difference of 0·07d. per 1000 B.Th.U. would tell up in the annual expenditure for the purpose. It would mount up still more with actual and not theoretical figures.

An Expensive Error of Judgment.

A good deal has been said about the excellent effect of the steam-turbine in reducing the fuel account, and therefore fuel costs, in electricity generating stations. But, of course, steam-turbines cost a great amount of money; and when anything goes wrong with them, it is a fairly serious business to have to adjust matters. Only an error of judgment on the part of an engineer-in-charge in the operation of a new steam-turbine, at the Derby Corporation electricity station, has proved a costly affair. The error placed the steam-turbine *hors de combat;* and the sum of £800 has had to be voted to readjust the effects of the error. The machine had been, during its few weeks' life, running satisfactorily. The engineer-in-charge has to suffer through his error. He has been asked to resign. But this experience ought to make of him a better engineer-in-charge. That is not our point. The incident shows that an accident to a steam-turbine may be a somewhat troublesome and expensive matter.

The Engineering Department of the Denver Union Water Company have, says "Engineering Review," devised some hypochlorate conversion tables for calculations after each hourly reading. These disclose the fact that the amount of hypochlorate applied hourly in pounds per million gallons of water per day (the latter a nomenclature recommended by the New England Water-Works Association, in preference to grains per gallon or parts per million) is nearly identical with the calculated parts per million of available chlorine when the latter is 36 per cent. of the total amount of hypochlorate used. When (say) 0·30 lb. is applied hourly to a weir-box on which the reading is 1 million gallons daily, the equivalent parts per million of available chlorine is 0·31.

IN THE INTERESTS OF GAS—A PLEA FOR SHOWROOM REFORM.

THE WEAK SPOT IN OUR PROPAGANDA.

By Cyril G. Davis.

In the course of a fairly-extensive commercial experience, I have been both interested and concerned to note the varying degree of importance with which the problem of the gas showroom is regarded by the many gas undertakings that serve the country. Generally speaking, the differences are seldom to be explained by the relative interests at stake; and the reason for them would, therefore, seem to lie in the disuniform development of what I may term the "Showroom Sense."

In not a few instances, it is true, the claims of the gas showroom have been handsomely recognized. In others, there are welcome signs of a tendency towards modernization. But in a large number of cases there is, I fear, a regretable lack of appreciation of the sales-promoting possibilities of a well-planned and properly administered showroom, and conversely of the menace that its negation may constitute to the best interests of gas.

So vitally important to the welfare of the industry at large do I consider this question of the gas showroom that no apology need be offered for making the accompanying observations, though, needless to say, I have neither the desire nor the intention to offend individual susceptibilities; my object being rather to focus general attention upon what I hold to be the weak spot in gas propaganda—namely, the indifferent support (often worse) that many so-called "showrooms" afford to the claims advanced, at considerable trouble and expense, in favour of gas and its manifold uses.

The True Function of the Gas Showroom.

In the discussion of any theme, it is both necessary and helpful to commence with a proper appreciation of "first principles." This, in the present case, implies nothing more than an understanding of the *raison d'être* of the gas showroom, and of what is, or ought to be, its proper commercial function.

For what purpose, then, does the gas showroom exist? and what part is it destined to play in the future development of the industry? As I conceive it (and most readers will be disposed to agree with me), the purpose of the gas showroom is to present gas in such a manner that its overwhelming superiority as an economical illuminant, as a convenient, efficient, and labour-saving (domestic and industrial) heating and cooking agent, and as a reliable and relatively inexpensive generator of mechanical power, should be convincingly manifest to every interested observer. And this ideal is the touchstone I desire to see applied alike to every existing showroom and to every prospective showroom scheme, whether of modernization or of initial establishment.

To estimate the part which the gas showroom is destined to play in the future development of the industry is to assume more or less the *rôle* of prophet; but, having broached the subject, I ought perhaps to venture an opinion. That the gas showroom is a potent commercial factor cannot be gainsaid; that it should be powerful for good will be as unanimously accepted; and that it is not at present rendering the fullest possible service to the cause, will also, I think, be generally conceded.

Yet I confidently believe that the time will come when the gas showroom as we have known it, will be as much a thing of the past as is the old "fishtail" burner, and that every gas undertaking which has not already done so will ultimately be compelled—principally in its own interests, but incidentally to the advantage of the industry in general—to bring its showroom or showrooms into harmony with the rising dignity and expanse of modern gas propaganda, and with the more cultivated tastes of an increasingly critical public.

And when, and only when, this desirable and necessary reform has been fully achieved, will the showroom wield its maximum power as the advance selling agent for gas; for so long as one showroom exists which tends to create an unfavourable impression on the minds of consumers, the vitality of our united efforts in the contrary direction is in danger of being sapped, and the money spent on advancing the general interests of gas is to this extent wasted.

Let us, then, have showroom reform—not the patchiness of isolated improvements, but a general movement that will sweep away every obstacle (so far as the showroom is concerned) that stands in the way of a universal appreciation of gas for lighting, gas for heating and cooking, and gas as a producer of power.

Some Showroom Weaknesses all have Encountered.

All who have been in close personal touch with the gas undertakings of the country will at once recognize the following as among the most frequently encountered defects of the gas showroom as it has been known—defects that can, and must be, remedied if the gas showroom is to fulfil its proper selling function. And unhappily, the summary is not by any means exhaustive.

An entrance of the kind that repels rather than attracts visitors.—The welcome to a gas showroom should surely begin at the outside; for the most carefully arranged interior is barren of effect upon those who cannot be induced to cross the threshhold.

Windows that need cleaning.—Of what selling value is the most carefully-set-out display likely to be when viewed through dirty windows?

The window display arranged after the fashion of the plumber or builders' ironmonger.—Modern gas appliances lend themselves to highly artistic arrangement; and there can be no legitimate excuse for treating them in any other way.

Bad ventilation, causing smell and "stuffiness."—A gas showroom is the last place in the world in which to remind consumers that gas may become unhygienic by neglect.

Old types of gas apparatus displayed to the worst possible advantage.—If it be necessary (as admittedly it sometimes is) to stock old-type appliances, there is no reason why these should not be displayed in the most attractive manner.

Apparatus of various types, jumbled together without semblance of order, and without regard to convenience for demonstration.—A small but well-chosen display, if properly exhibited, is better calculated to interest the consumer than chaotic profusion, and on no account should superfluous stock be allowed to remain in the showroom if it can possibly be avoided.

Untidiness, discourtesy, idle lounging, and technical ignorance on the part of the salesmen.—It is the *personnel* of the showroom that either clinches or stultifies the silent argument of the display. Tidiness, alertness, respectful courtesy, willingness to oblige, selling ability, and accurate knowledge of the apparatus shown, are qualifications which should be required of all the showroom staff.

Gas light fittings of obsolete pattern, or that have become soiled in use, or that have burnt deposits adhering to them.—Up-to-date gas-fittings are themselves a powerful advertisement for gas; and daily attention to them is the easiest way to maintain their selling appeal.

Cracked and sometimes broken chimneys and globes, or (in some cases) these items absent altogether.—So far from helping to sell gas, such defects merely remind the consumer of the expense of renewals.

Gas-fittings with inappropriate or inartistic shades.—The display of a little taste may well prevent the visitor preferring a competitive form of light.

Broken gas-mantles, or mantles badly shrunk, and for that reason not developing the full candle-power of the gas.—Such defects constitute a serious libel on gas as an illuminant.

Bye-passes extinguished, causing an unpleasant escape.—Everyone knows that gas does sometimes escape; but one ought to be allowed to forget it in the gas showroom.

Gas cookers with parts missing, or with scratched surfaces or rusty polishings.—The showroom cooker can be made a convincing argument for cooking by gas, and indeed it ought never to be anything else.

Cooking utensils untidily arranged on gas-cookers.—The average housewife is a methodical person, to whom any kind of disorder is an eyesore.

Gas-fires with fuel of the wrong pattern, or with fuel broken or missing.—An attractive gas-fire, shown as it should be shown, may be the means of selling quite a lot of gas.

Matches strewn about the floor near to demonstration apparatus.—A disfigurement is usually the first thing to catch the eye; and untidiness of this kind is a sales-killing distraction.

Show tickets soiled, bent, or broken.—A dowdy showcard is worse for gas than none at all.

Description cards placed on the wrong apparatus.—Carelessness of this kind brings the showroom into ridicule.

Insufficient floor covering; in some cases none at all.—"Comfort begins with the carpet," and generous floor coverings in the showroom help materially to associate gas with comfort—to the advantage of gas.

Neglected ceilings and walls, suggesting that gas and cleanliness have little or nothing in common.—To foster an impression so bad for gas costs more in the long run than an occasional coat of whitewash or paint.

A general atmosphere of shabbiness and neglect and of depressing dinginess.—This is fatal to gas, which has its own domestic charm, and should be represented in its most cheerful aspect in every gas showroom.

I may add, by way of diversion, that I have somewhere encountered a gas "showroom," which served also as a laundry receiving office! Doubtless the washing counter would share the establishment expenses and benefit as a department by a corresponding reduction in its own outgoings. But who with a grain of business acumen could imagine that an economy effected by so incongruous an alliance could operate in any way to the advantage of gas?

It will not be denied, I think, that the existence of the foregoing and kindred weaknesses—all *anti*-gas in their influence—must necessarily militate against the object for which every gas showroom must be presumed to have been established.

The Right Policy.

In my opinion, there is but one policy that will ensure a gas showroom becoming, and remaining, the out-and-out advertisement for gas that every gas showroom ought most certainly to be. That policy is for all concerned—from the chairman down to the humblest cleaner—to keep permanently in view the purpose for which the gas showroom exists, and regulate every decision and act connected with it by applying the test, "Is it good for gas?"

This policy is admittedly less easy to carry out in practice than t is to formulate in theory, and in many cases its adoption would entail reform of a very drastic order. Nevertheless, I suggest that showroom modernization is an economy of the right kind, and one that should be resolutely initiated the moment the need for it has been made manifest; for it is the veriest truism that a gas showroom that is doing nothing for gas is doing little if anything more for those who maintain it.

As a first step, let all such weaknesses as those I have referred to (where they exist) be rooted out, and then, if need be, the larger questions tackled in turn:

Are the premises suitable, or can they be made so? If not, let the lease be disposed of.
If suitable, are they planned to the best advantage, having regard to the purpose in view? A specialist's opinion on this point is worth obtaining.
Does the decoration assist the general scheme? It can surely be made to do so.
Is the lighting eloquent for gas as an illuminant? Gas should advertise itself as the next best thing to daylight.
Is the show stock what it should be—representative, up-to-date, and convincing? If not, overhaul it, and remove whatever offends.
Is the display arranged to best advantage? Invite criticism and respect it.
Is the *personnel* a credit and is the showroom and all it contains kept scrupulously clean?
Lastly, does that intangible selling asset, "co-operation," exist between the showroom and the outside selling staff? If not, it should be sedulously cultivated; for the work of the one is in every sense of the word complementary to that of the other.

To Crystallize my Message.

A gas showroom, to be in very truth a gas showroom, must be housed, planned, decorated, stocked, staffed, and administered exclusively in the best interests of gas; for in this and in no other way can the gas showroom be made to justify its title. And while a showroom so conducted may not always make a direct, actual profit on its working, let it not be forgotten that a gas showroom s primarily and essentially an advertisement, and considered in this light will invariably be found to pay for itself, like any other well-directed effort to secure the favour of the public.

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CAPTURING GERMANY'S TRADE.

Internal Combustion Engines.

Much has been written and spoken on the subject of the recapure and expansion of British trade while the ports of Germany are closed to overseas traffic, and not by that country's own will and pleasure. There is before us another considerable contribution, in the shape of a pamphlet containing some thirty-two pages of closely printed matter, and somewhat overdone for the purpose. It has been prepared by the permanent staff of the International Schools, Limited, of Kingsway, W.C.; and while we do not deny that it is well written, and that no exception can be taken to the statements contained in it, the points, in our opinion, could have been enforced, and the objects attained, within much closer compass. As it is, we think, after all that has been written, that the pamphlet will miss its mark, through wearying the reader with the saying at length of so much that has been said before, and upon which there is very general agreement now, if not universal practice. The pamphlet is intended to deal particularly with internal combustion engineering; and we are told in a covering letter that t "is entirely supplementary to the regular instruction papers prepared and issued by us on these subjects, and is especially written for the benefit of those engaged in this industry, and who are studying with the schools with a view of improving their knowledge, position, and income."

In diligently ploughing through the pamphlet, one finds that he has to go something like half-way through its contents before the subject of internal combustion engineering is reached. Prior to this, German organization and educational methods are treated upon, and in large extent are held up as a pattern. The stimulus that is given in that country to invention and research is dilated upon; and the technical education that Germany has found so beneficial in her industrial and commercial development is held up—and we can all accept it—as a large factor in the successful making of war on German trade. "It is essential to success in ndustrial warfare that the faculties of inventiveness and resourcefulness should be stimulated and developed by proper technical instruction." Note, "proper" technical instruction. The pamphlet urges that the utmost encouragement should be given to, and the utmost use be made of, institutions devoted to technical nstruction. While agreeing with this, we cannot regard "Correspondence Schools" as affording the equivalent of a course of trainng at the universities, colleges, and technical schools, with departments for the scientific training required in connection with special industries, and preparatory to the practical training on the works. Correspondence schools no doubt have a useful place among our institutions, in helping those who, unfortunately for themselves, have not the means nor the time to take advantage of the scientific training offered them by the universities, colleges, and the technical schools. The best training is that which is most thorough; and training by correspondence cannot claim to be all that the engineering shops and the laboratory under skilled men are to the student.

But these thoughts are all preliminary to reaching the portion of the pamphlet dealing with internal combustion engineering. In relation to gas-engines, we are told that the Germans have brought their powers to bear on the problems associated with them, and have secured a good portion of the trade. It is also pointed out that important structural details of gas-engines have been worked out more thoroughly and scientifically in Germany than here. This is true, and so is the converse of the statement. Some important structural details have been worked out quite as thoroughly and scientifically here as in Germany. We cannot claim or even expect a monopoly in improvement. For horse powers running from low up to fairly considerable figures which may come within the category of "ordinary," we are not prepared to admit that the Germans are our masters in scientific construction over all; but we do award them the palm for engines of considerable magnitudes in horse power operating on blast-furnace or coke-oven gas. In the building of large engines, we agree with the pamphlet that they have beaten us in cost—not through any superior technical ability, but possibly owing to equipment, standardization, commercial organization, rings, bankers' aid, wages, trade union restrictions, &c. But the greatest reason of all is demand. There has not been, until lately, the demand in this country for these large engines, because this country was so far behind Germany and Belgium in developing power economy by the employment of waste gases.

Germany, too, admittedly has done a large part in commercially fostering the Diesel engine. But Germany is not entitled to the credit for the genesis of this engine. It was due to one Brayton —an American—forty years ago; but Rudolf Diesel perfected the machine. "This by the way," remarks the pamphlet, "simply furnishes another instance of how the Germans—and be all credit given to them—readily seize on other people's crude ideas, and forthwith proceed to bring them to fruition." However, it is mentioned that these engines have, under suitable circumstances, obtained considerable favour in this country as a means of utilizing crude fuel in a direct manner, and "without the intervention of the boiler and the producer plant required in connection with steam and gas engines respectively." That is evidently looked upon as something particularly advantageous to the Diesel engine. But the use of crude fuel of the kind means that the engine owner has to buy, convey, store, and handle this crude fuel, and to see that he does not run short of it; whereas gas-engines up to fairly large horse powers do not by any means universally run on producer gas, but largely on gas piped from the town mains direct to the engine, and there used without the slightest trouble or concern as to its provision and storage. On the other hand, it is agreed that the popularity achieved by the Diesel engine was due very largely to the whole-hearted manner in which it was boomed by the German manufacturers; and there is at present a rather widely-held opinion that it was somewhat over-rated.

Well, now, the pamphlet informs readers that Germany has been exporting gas and oil engines to the value of about £1,100,000 yearly; and there is no reason why this country should not obtain a share of this business. But immediate action is necessary; and here we are, in the pamphlet, brought back to the consideration of the position that technical education and kindred matters must occupy in the trade-getting campaign. This is a good place to close the review of the contents, with the single additional remark that anyone who is not already overloaded with the subject, or who has not heard of it before, or who has not considered it in its manifold bearings, might do worse than secure a copy of the pamphlet.

Gas-Engine Efficiencies.

Writing recently in the "Engineer," Mr. C. Percy Taylor, of Gravesend, gave the following figures relating to a four-cylinder 30 B.H.P. horizontal gas-engine of one of the leading English makers —tested, he said, under his own supervision:

	Full Load.	Three-quarter Load.	Half Load.
Brake-horse-power	289·0	234·0	161·4
Gas consumption reduced to 60° Fahr., 30 inches bar., cubic feet per hour	19,215	17,080	14,220
Lower calorific value in B.Th.U. per cubic foot	112·8	112·9	116·0
B.Th.U. (lower value) in gas per B.H.P. hour	7,510	8,233	10,250

The engine had been running for some months at the time the tests were made; and they were conducted entirely independently of the makers.

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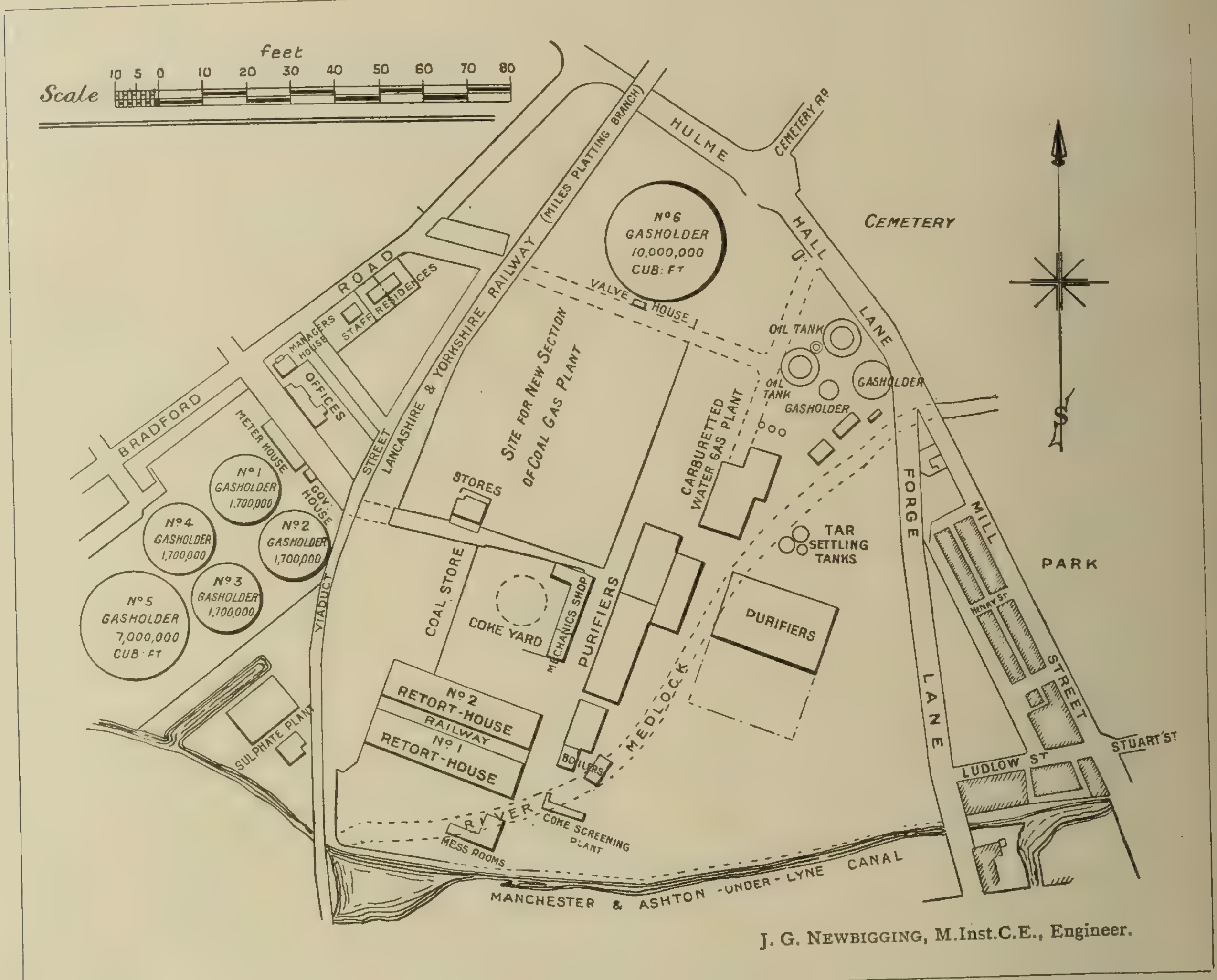
The Supply of Thorium.—The Lindsay Light Company, of Chicago, have appointed as their Agents in this country Messrs. Paul Windmuller and Co., Limited, of No. 72, Mark Lane, E.C., in order that their clients may secure prompt and efficient service without the trouble and delay of writing out to the States. It is clear that, through the action of this and other concerns, there is unlikely to be a repetition of the shortage in thorium which was inconveniencing the industry a few months ago. It is stated from America, however, that the supplies of imported thorium in that country are now entirely exhausted; and it may therefore be imagined that the American home market is likely in consequence to make ever-increasing demands on the Lindsay plant.

THE BRADFORD ROAD GAS-WORKS OF THE MANCHESTER CORPORATION.

A DESCRIPTION OF SOME OF THE MORE IMPORTANT FEATURES.

Prepared for the Visit of the Manchester District Institution of Gas Engineers, Oct. 30.

By J. G. Newbigging, M.Inst.C.E., President.



J. G. Newbigging, M.Inst.C.E., Engineer.

PLAN OF THE BRADFORD ROAD STATION OF THE MANCHESTER CORPORATION GAS-WORKS.

The Bradford Road Gas-Works is the largest of the four stations of the department, covering an area of 52 acres 3856 square yards. The manufacturing capacity of the works is 10,000,000 cubic feet of coal gas, and 8,000,000 cubic feet of carburetted water gas, per diem. The storage capacity is 23,800,000 cubic feet, in six gasholders, varying in capacity from 1,700,000 cubic feet to 10,000,000 cubic feet. The value of the works at March 31, 1915, was as follows:—

Land	£127,057
Buildings	254,731
Apparatus	526,661
	£908,449

In the following brief description, attention is simply drawn to the more important features of the works.

Coal-Gas Plant.

The carbonizing plant is installed in two retort-houses, each of a nominal capacity of 5,000,000 cubic feet per diem, although the highest make in one house has reached 5,700,000 cubic feet per diem.

In each house there are 28 beds of nine retorts in each bed, set in three tiers. The length of each retort is 20 feet, and 24 in. by 16 in. ◠ section. The quantity of coal carbonized per retort averages 36½ cwt. per twenty-four hours, in six-hour charges; and the highest yield per mouthpiece per diem has been 11,309 cubic feet. The charging and drawing of the retorts is effected with West's compressed air machines.

Reconstruction of No. 1 Retort-House.

This retort-house is in course of reconstruction by Messrs. Drakes Limited, of Halifax. The new benches are arranged in four sections—two benches of six beds and two of seven beds. Each bed contains ten retorts, set in five tiers; the retorts being 22 feet long and 24 in. by 18 in. ◠ section.

Ascension pipes, 7 inches internal diameter, are provided at each end of the retorts. The hydraulic mains are kept well above the bench, so as to prevent undue heating, and are arranged in sections to receive the gas from three and four beds.

Each length of hydraulic main is made with a fall of 8 inches to the tar outlet, which latter is tapered from 18 to 12 inches in diameter, and connected to the tar-towers. This arrangement obviates the use of the usual tar-pipes. The gas from each hydraulic main—of which there are two to each of the four benches—is governed by means of a 10-inch Braddock's retort-house governor.

The machinery is of the Fiddes-Aldridge type; and two machines will be provided. The coal-feeding hoppers extend the whole length of the retort-house, and are of twenty-four hours' capacity. Electrical plant, in duplicate, of a capacity of 200 K.W., will be installed in an adjacent building—the Corporation supply being utilized as a stand-by.

The method of dealing with the hot coke and its removal from the retort-house has not yet been finally decided upon.

Carburetted Water-Gas Plant.

This plant is of a total capacity of 8,000,000 cubic feet per diem, in four sections of 1,250,000 cubic feet each and four sections of 750,000 cubic feet each per diem. The blowing plant comprises two Marshall engines, and two De Lavel turbine engines, each coupled to a Sturtevant fan. The exhausting plant consists of two exhausters of Messrs. R. & J. Dempster's make and two made by Messrs. George Waller and Son. The steam supply is provided by six Lancashire boilers.

A relief gasholder, 80 feet diameter, and two oil-storage tanks are erected at a short distance from the building.

Experimental Gas-Works.

An experimental gas-works has been erected at this station complete in every detail from retort to governor. The capacity of the works is 60,000 cubic feet per day, and is so arranged that it can be increased to 100,000 cubic feet per day at very little additional cost.

Sulphuric Acid Plant.

The sulphuric acid plant is of the usual chamber type, and is apable of making about 100 tons of chamber (120° Twaddel) cid per week. The chambers are four in number; three being o ft. by 26 ft. by 16 ft. 5 in., and the fourth, recently added, o ft. by 22 ft. by 17 ft. 6 in.

The Glover tower is 28 feet high by 8 feet square, and is packed ith the "Nori" patent packing bricks. There are two Gay-ussac towers—the larger, 40 ft. by 8 ft. square, packed wtih oundry coke, the smaller, 25 ft. by 5 ft. 9 in. square, packed with Mackensie" patent tiles. The burners are of the shelf type, and e suitable for burning either pyrites smalls or spent oxide as may be required. But as they are about worn out after constant use for over 13 years, it has been decided to erect in place thereof six of Wyld's mechanical burners, in which the oxide is drawn, by means of a chain with scrapers attached, through a two-shelf combustion chamber with discharge of the burnt oxide at the front end of the burners. The foundations for these are already in; and it is hoped that when the burners are completed the output of acid will be increased by 15 to 20 per cent. In addition to the burners, a small kiln has been built for burning the gases sent over from the sulphate plant.

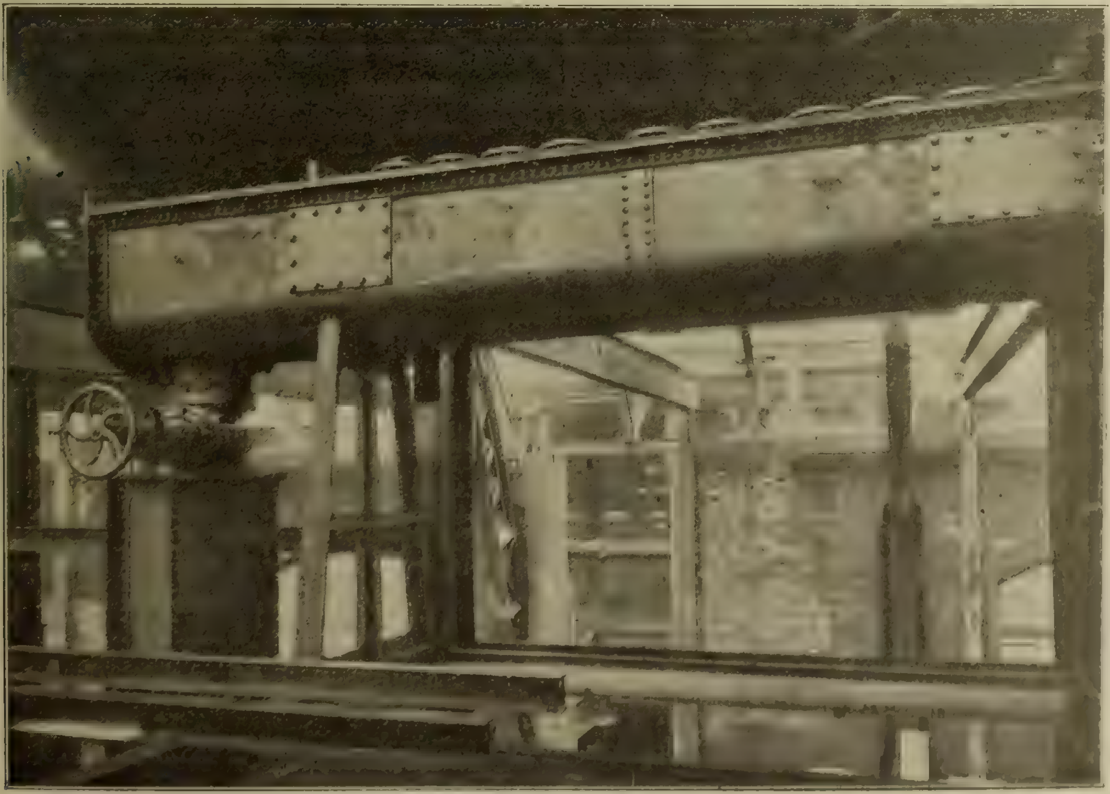
Besides the above there are the usual air compressors, acid eggs, tanks, pumps, &c., required to make the plant complete. A Kestler acid fan (fixed between the Gay-Lussac towers), used to reduce the pressure in the chambers, may be of interest.

Sulphate of Ammonia Plant.

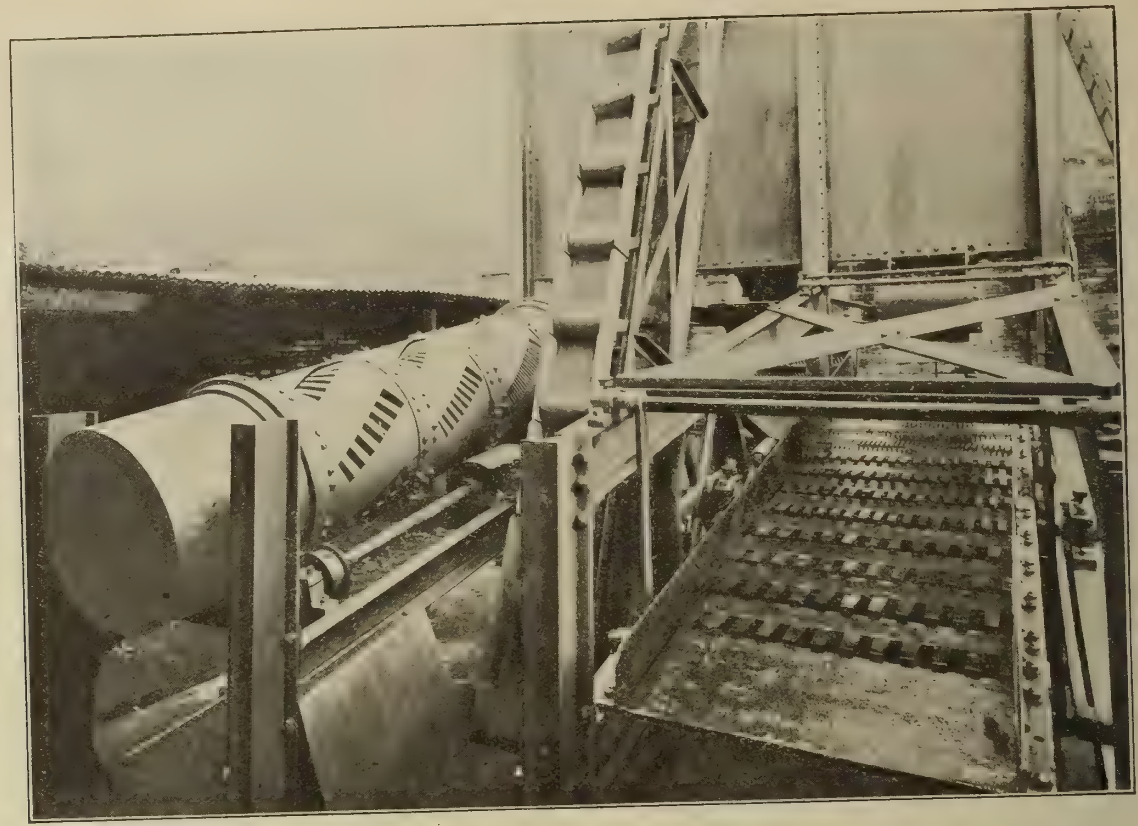
The sulphate of ammonia plant is in duplicate; each unit being capable of making from 20 to 24 tons of salt per day. This plant, with the exception of four Holmes stills used for fixed ammonia, is

The Charging Side of the Reconstructed Retort-House.

The Discharging Side—Before the Erection of the Stage-Floor—of the Reconstructed Retort-House.



THE HYDRAULIC MAIN AND TAR-TOWERS IN THE RECONSTRUCTED RETORT-HOUSE.



DRAKES' PATENT SCREENING PLANT.

of the Wilton pattern, with closed saturators and automatic discharge into centrifugal baskets, where the salt is dried before falling on to inclined conveyors along which it is taken for storage under the acid chambers. The waste gases are, as stated, burnt in a kiln on the acid plant—providing about 16 to 17 per cent. of the sulphur required for acid making. The whole of the ammoniacal liquor from the various works of the department is treated in this plant; the output of sulphate of ammonia being about 5000 tons per annum.

Toluene Plant.

The toluene plant at present under construction for the Government by Messrs. Simon-Carvès, Limited, is for the treatment of a maximum of about 8,000,000 cubic feet of coal gas per day. The gas is to be taken off between the purifiers and the meters; being divided into two streams, each stream passing through three scrubbers and then carburetted before again passing into the works' mains. An exhauster with bye-pass has been added for forcing the gas through the scrubbers should the back-pressure be too high.

The scrubbers are 7 ft. 6 in. diameter and 55 feet high, filled with boards for distributing the washing oil and bringing the gas in intimate contact therewith. The washing oil will be pumped through the scrubbers in series in the opposite direction to the gas, then passing into the storage tank as rich oil. For the separation of the toluene, &c., this rich oil, after preheating, is passed through stills heated with wet steam, by which means a crude naphtha is separated from the oil. The latter is returned for use again, while the crude naphtha is sent through a rectification still, where it can be treated with either wet or dry steam for the purpose of raising it to the necessary degrees of heat for separating the benzol and toluol by fractional distillation, and leaving a residue of solvent naphtha, which will in all probability be sent away in the crude state. The benzol and also the toluol will, however, have to be washed with sulphuric acid and afterwards with caustic soda, and the washed products again distilled before the pure product is obtained.

Coke-Breaking Plant.

The coke-breaking plant consists of one of Cort's coke-cutting machines of their usual pattern, and fed by bogies direct from the retort-house. After breaking, the coke is elevated and deposited on a "Bentley" balanced shaking screen, made by the New Lowca Engineering Company, Limited. This screen is 88 feet long, 4 feet wide, made in two halves, and works over the various hoppers; the screens being arranged to divide the broken coke into five sizes suitable for the various uses of the district, and ranging from fine (almost dust) to pieces over 1½ inches in diameter.

The hoppers are each of about 20 tons capacity, and from these the carts are loaded direct, with the exception of the No. 2 size, which is always washed. Every care is taken to keep the various grades as clean as possible, so as to foster the trade. At the present time, about 20,000 tons of coke are broken annually.

Pan Breeze Washing Plant.

Plant for washing the pan breeze from the generators of the carburetted water-gas plant, and incidentally from the producers of the coal-gas plant, has been erected. This is of Messrs. Head, Wrightson, and Co.'s make, and is capable of dealing with about 4 tons of pan breeze per hour. The pan breeze is fed into an underground hopper holding about 12 tons, and from this, through an automatic feed, to the elevator for delivery on to a screen, where the fine dust is taken out and deposited into a hopper for loading into carts. The remainder of the pan breeze passing into the washer proper meets a strong stream of water, which drives the light coke along its surface and sends it over a weir, where it falls on to the bottom tray, along which it travels to the coke hopper. The heavier clinker sinks through the water on to the surface of the top tray, to travel along it in a contrary direction to the coke until it falls into the clinker hopper. The water, after use, runs into a settling tank, to be employed again for the same purpose. The peculiar motion of the washer is imparted by Marcus machinery.

Drakes' Patent Screening Plant.

This is of rather novel design, and is one likely to be found very useful for gas-works purposes. In place of the usual bars or perforated plates, plates the full width of the screen have gaps cut along one side, for a depth of 4 or 5 inches—thus forming what might be called a forked plate, of which the forked portion only is bent slightly upwards. These plates are so arranged on the screen that the forked side of one plate lies slightly over the solid side of the plate next below, and so on. On passing coke or other material slowly over these plates, the small is screened out through the gaps between the prongs, while the large passes on to the mouth. The material, having a natural tendency to clear itself from between the prongs when passing over them, prevents the blocking of the screen.

By varying the width of the gaps between the prongs, the coke can be successfully graded into such various sizes as are required. The screen can be made with a steep angle so that the material runs over it without the aid of machinery, or it can be set nearly horizontal and given a forward motion by means of links and an eccentric. The screen that is now in operation at the Bradford Road works, which has been put up for experimental purposes, is of the latter description.

Workmen's Dining Room, Lavatories, &c.

The workmen's dining room erected at these works, which has been in use for the past eighteen months, has been found a great convenience to the men, and is much appreciated. There is a kitchen fitted with the necessary gas-stoves, warming ovens, &c., for cooking or warming food as may be required. A locker room alongside the lavatories for washing enables the men to change their clothing in comfort. The working of these rooms is (subject to the general management of the works) in the hands of a Committee elected by the men from among themselves—a method we have found to work very well.

THE ASTORIA TUNNEL UNDER EAST RIVER FOR GAS DISTRIBUTION IN NEW YORK CITY.

THE FLOODING AND RECOVERY OF THE TUNNEL.

By Harold Carpenter, Resident Engineer, Astoria Tunnel—Astoria Light, Heat, and Power Company, New York City.

Synopsis.—The great difficulties in holing-through the headings of the Astoria tunnel, described in these pages about two years ago, were surpassed by troubles arising in the bench excavation. The tunnel was drowned-out, except for the Bronx end, which was saved by a narrow margin. Grout-sealing on a huge scale finally controlled the leak. The tunnel was pumped-out, while some leakage still continued, by combined air-lift and pump-work. Erratic pressure-gauge readings in the bulkheaded heading. The jammed bulkhead door and the open drain-pipe. Leak finally grouted through a 22-feet drill-hole from the Astoria bulkhead. Excavating the grout filling the heading—a volume twice that of the cement used. Final bench work and lining with cast-steel rings.

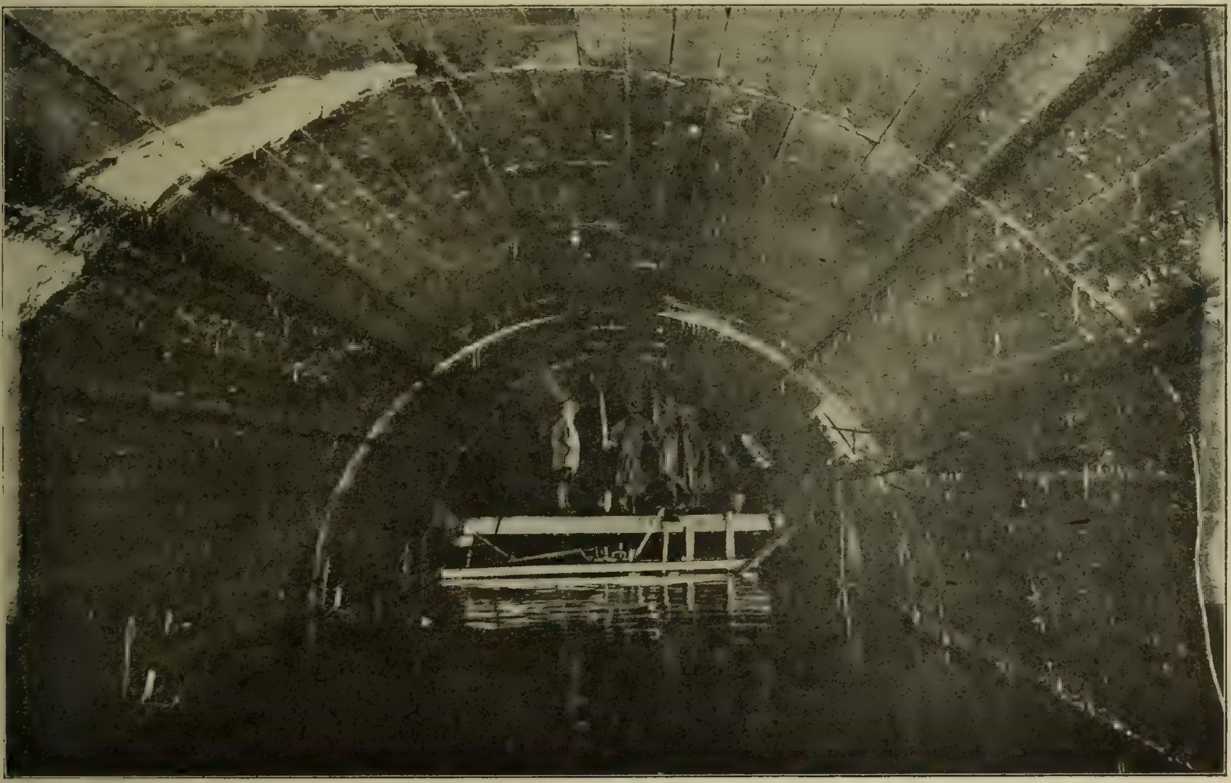


FIG. 1.—SHOWING THE ASTORIA TUNNEL, ON DEC. 1, 1913, PARTLY UNWATERED, AFTER THE FLOOD OF OCT. 5, 1913, CAUSED BY A LEAK IN THE BENCH AMOUNTING TO 12,000 GALLONS PER MINUTE.

wo years ago—shortly after an article describing the construction of the Astoria tunnel up to the point of holing-through on ly 17, 1913, was published in these pages[*]—a tremendous flow f water burst into the tunnel, flooded three-quarters of its length, d (filling the Astoria shaft) submerged the pumping plant. he following recounts the chief events in the successful struggle recover and complete the tunnel.[†]

The tunnel is 4662 feet long. Its ends are in Fordham gneiss, r distances of 1200 feet north from the Astoria shaft, and 750 et south from the Bronx shaft. Between these two points it asses through Inwood dolomite; and it was on the contact etween these two rocks nearest the Bronx shaft, for a distance of bout 400 feet, that seams of disintegrated rock carrying water nder high pressure (95 lbs. per square inch) were constantly encountered.

The width of this contact zone of decomposed rock was found be about 150 feet normal to the strike; but owing to the tunnel rossing it at an angle, the greater distance was involved.

Because of the fact that the tunnel was 250 feet below the surace of the river, and therefore compressed air could not be used, e building of the tunnel through this water-bearing section preented unusual difficulties and required unusual methods to overome them. Still greater difficulties presented themselves when e tunnel was flooded by the great leak of Oct. 5, 1913.

Holing-through Heading: No Further Trouble Expected.

At the time of holing-through the heading, July 17, 1913, all trouble from disintegrated rock seams and water in the heading had been overcome. Two safety bulkheads across the full section of the tunnel, and three safety bulkheads across the heading to protect the completed portions of the tunnel against flood (as well as twenty-nine temporary bulkheads across all or part of the heading, in order to confine the water for grouting), had been constructed during the excavation of the heading through this 400-feet section.

After holing-through, there remained 43 feet of heading to be widened to the full cross-section, and 474 feet of bench to be removed, which included all of the bench through the trouble zone. The two safety bulkheads across the full section of the tunnel were still in position—one at each end; and two safety bulkheads were still in place across the heading on the top of the bench.

All water-bearing seams encountered during the driving of the heading had been successfully grouted under high pressure (500 lbs.); and the flow of water had been stopped. Direct connection of the seams with the surface of the river had been revealed during the grouting; but all evidence led to the belief that this had been shut-off with the grout.

Test holes 16 feet long had been systematically drilled along the bench at the points where the seams lay, from 1 foot to 5 feet apart, without striking any water; and as the water had always come in from above, and never from the bottom, it was considered improbable that further trouble would be encountered.

Excavation of the heading to full cross section was completed on July 24, 1913; and the concrete lining of the arch above the springing line on July 25, 1913. The two safety bulkheads across the full section were too far from the faces of the bench to be of use (150 feet and 200 feet respectively). They were, therefore, removed; and as there appeared to be no further need to construct new ones closer to the work, excavation of the bench was resumed on Aug. 14, 1913. The bench had not been advanced at the Bronx end since July 23, 1912, and at the Astoria end since Nov. 14, 1912, on account of trouble in the heading.

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[*] See "Journal" for Aug. 5, 1913, p. 363.

[†] The Astoria tunnel connects the Astoria plant of the Consolidated Gas ompany of New York at Astoria, on the north-west corner of Long Island, ith a future distributing station at East 132nd Street and East River, ronx [see fig. 2]. It will be used to carry gas by means of 72-inch caston mains from the Astoria plant, which will be the largest gas plant in the orld, with its ultimate capacity of 240,000,000 cubic feet of gas in 24 hours 0,000,000 cubic feet of which is now constructed and in operation), to the rowing northerly section of New York City, the Borough of Bronx, the opulation of which has increased from 88,000 in 1890 to 730,000 (estimated) 1915. The reasons for its construction, its general details [see figs. 2 nd 3 of the present article], and the difficulties encountered and successully overcome up to the time of holing-through the heading, were described the previous article—see preceding note.

Water in the Bench and Attempt at Grouting.

For three weeks work progressed satisfactorily—353 feet of bench being removed. On Sept. 4 a test-hole at the Astoria end of the bench, about 3544 feet from the shaft, drilled in an exactly similar manner and location to the previous exploring test-holes, struck water under full pressure—giving a flow of 1000 gallons per minute. Several additional holes also struck water under pressure. The total flow from these holes was about 1600 gallons per minute. On the same day, a test-hole at the Bronx end, or about 100 feet north of the others, struck a 3-inch stream of water, but without pressure.

A temporary buttress, 20 feet long, was built along the top of the bench against the side of the heading, and timbered against the opposite side of the heading, to confine the water for grouting. The holes were piped through the buttress, and valved as usual—being allowed to flow for one week, until the concrete had thoroughly set. The valves were then closed, preparatory to grouting, when instantly the water burst out through the top of the bench. The water pressure cracked the buttress in both directions.

Safety Bulkheads Built in a Hurry.

Work was immediately started (Sept. 11, 1913) on a safety bulkhead at each end of the bench, across the full section of the tunnel, to protect the completed portions of the tunnel and shafts from flood.

In the meantime (on Sept. 12) a heavy flow of water occurred through the buttress drains and the top of the bench, bringing in large quantities of beach sand, shells, all sorts of débris—including wood, spools, tin cans, &c.—and about a ton of coal in pieces as large as 4 inches and 5 inches, showing that there was a direct connection with the river bottom. About 100 cubic yards of material came in in less than an hour, when the holes clogged, and the flow of refuse stopped—the water continuing.

Although such a direct connection existed with the river bed, no fish came in at any time during this flow or the subsequent flooding; while during previous water flows, when driving the heading, large quantities of live fish as long as 8 inches came in.

On Sept. 24 the two safety bulkheads across the full section of the tunnel, one at each end of the 121-feet section of the remaining bench [A and B, fig. 4], were finished, ready for use in an emergency. Several 8-inch and 10-inch drain pipes were built into each of these bulkheads below the doorways, with valves on the outside of the bulkheads. The doors were hinged on the inside, and arranged to drop instantly on releasing a cable from the outside.

These bulkheads were completed just in time. Had it not been for them, the entire tunnel and both shafts would have been flooded on Oct. 5, 1913, under the circumstances described in what follows. As it was, only one shaft and one end of the tunnel were kept from being flooded. This undoubtedly prevented much more serious difficulties and much greater expense in recovering the tunnel.

Second Attempt to Grout the Leak.

The buttress that had failed was now removed and a much larger one was built, about 35 feet long, at the same location, well tied into the side of the heading, and very heavily timbered against the opposite side of the tunnel. Other buttresses were also constructed along the bench wherever test-holes had shown the presence of water or the rock seemed bad. [See fig. 4.]

On Oct. 1, the buttress having had one week to set, the valves on the pipes were closed, and grouting began. Immediately the large buttress [A, fig. 4] cracked in both longitudinal and transverse directions, and moved bodily away from the side of the heading a distance of $\frac{3}{4}$ inch, crushing the timbers that were braced between it and the opposite side of the heading. This buttress weighed 112 tons.

Its removal was at once started, in order to gain space in which to construct another in the form of an inverted arch. The buttress was removed as carefully as possible; blasting being done by means of very light charges, in order not to disturb the rock and cause a flow of water and débris.

Tunnel and Astoria Shaft Flooded.

On Sunday morning, Oct. 5, 1913, the removal of the large buttress [A, fig. 4] was completed and ready for concreting a new one, in the form of an inverted arch to replace it. At 7.40 A.M. the water coming in through the pipes and the top of the bench suddenly increased in volume, and brought in a large quantity of greensand and débris. It ran thus for about half-an-hour, when it suddenly subsided again to its average flow of about 2500 gallons per minute. The sand was cleared away from the bulkhead doors; but it did not appear necessary to close them, as the flow had subsided.

At 9.30 A.M. the heavy flow of water with sand and débris again broke out, in much greater volume than before. The men on duty, alarmed, at once prepared to close the bulkhead doors. Only with the greatest difficulty was the débris cleared away from the Astoria bulkhead [A] enough to allow the safety-door to drop. This was finally accomplished—some of the men remaining on the outside to close the valves on the drain-pipes. Others went out through the Bronx bulkhead [B] and dropped the Bronx door. Some of the men ran for the shafts. The men on the Bronx side were able to close all the valves on the drain-pipes through the Bronx bulkhead, as the force of the water was broken and the sand held back by the intervening bulkhead C [see fig. 4].

At the Astoria bulkhead, however, after the men had dropped the door, the rush of water and the sand came so fast that they did not have time to close the drain-pipes. The pipe, remaining open, continued to discharge an 8-inch stream into the tunnel under 95 lbs. pressure. It was afterwards found that a 1-inch board had jammed in the doorway, and water also poured into the tunnel underneath the door.

In about an hour-and-a-half the pumps at the Astoria shaft, which had a rated capacity of 7700 gallons per minute, were all

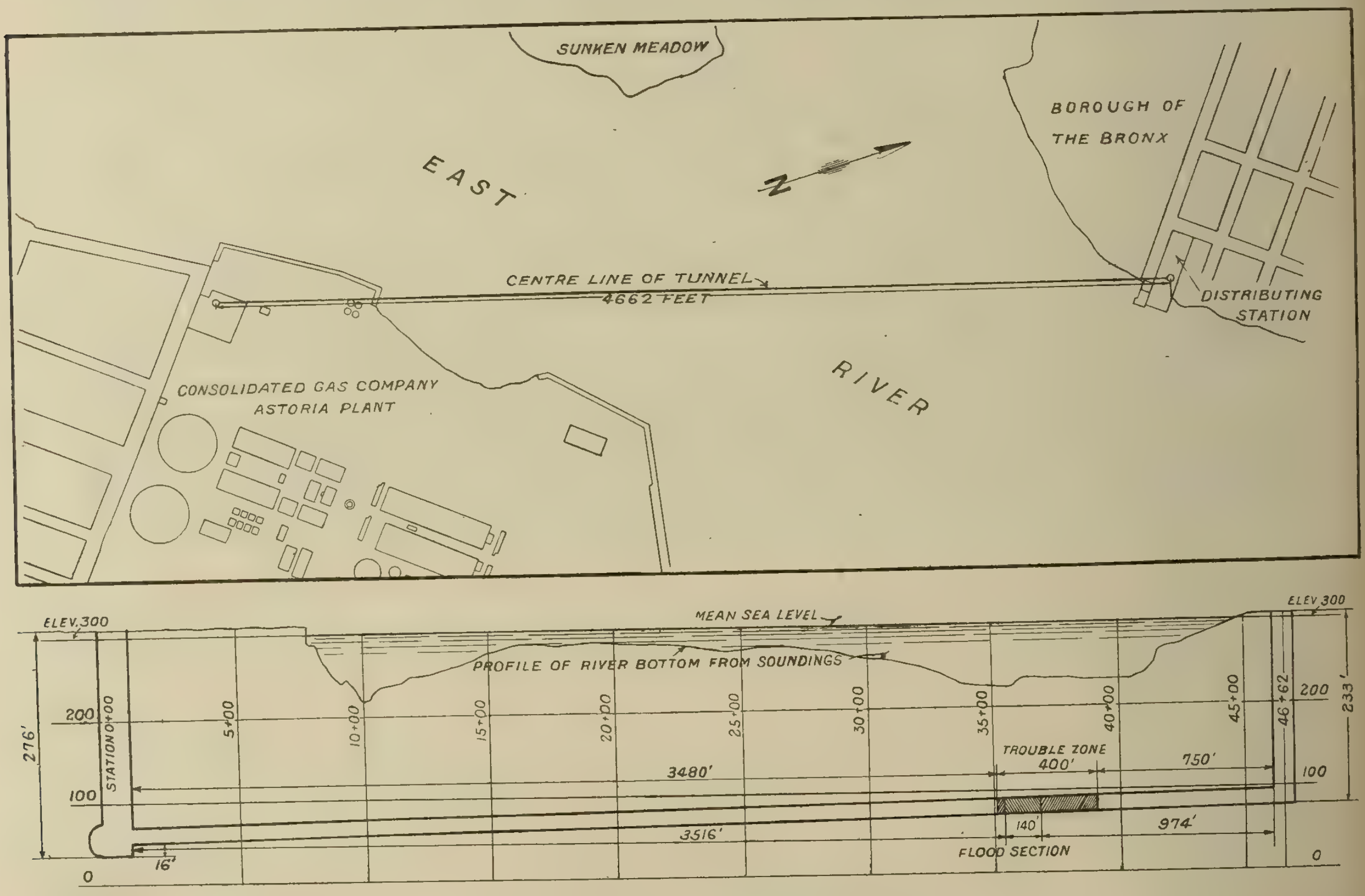


FIG. 2.—PLAN AND PROFILE OF THE ASTORIA TUNNEL, NEW YORK.

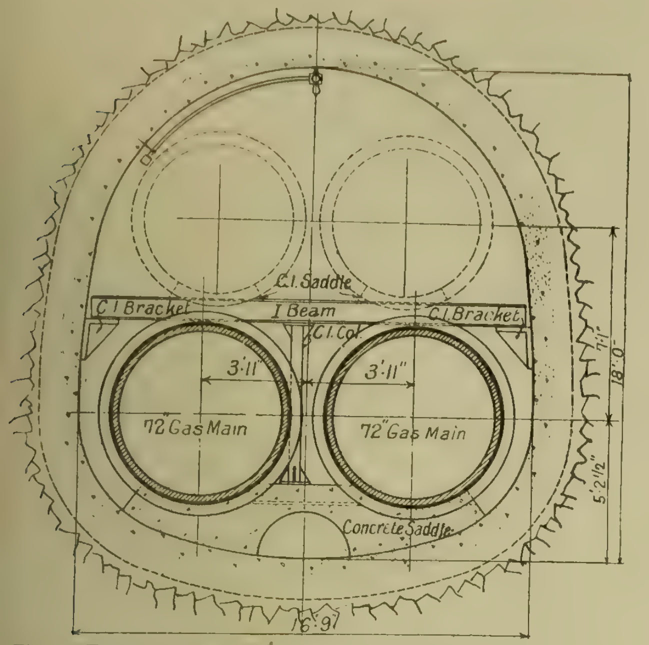
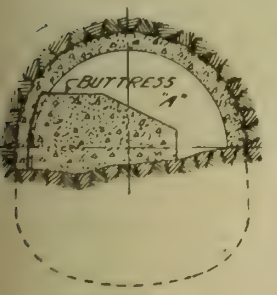


Fig. 3.—Typical Section of the Astoria Tunnel, with Pair of 72-inch Mains being Laid and Provision for Additional Mains.

bmerged. Some of the pumps continued to work until 4 P.M., hen the last one stopped. The estimated flow of water from the ak was 12,000 gallons per minute. At 8.15 P.M. the next day ct. 6) the water reached low-tide level, and began to rise and ll with the tide.

From 9.15 A.M. to 6 P.M., bubbles appeared on the surface of the ver directly over the point of leak for an area about 250 feet square; one main body of bubbles extending over about 50 feet by 100 feet. These bubbles appeared at a point about 400 feet south of the point where similar bubbles had appeared on April 8, 1913, during the grouting of a large leak in the heading with air-pressure of 500 lbs. (which had successfully shut-off water from the heading). This showed that the new leak was from an entirely separate and new connection with the river bottom. Air also escaped from a small pipe through the Bronx bulkad [B] at the same time.



Section at AA.

The water in the shaft reached high-tide level for the shaft at P.M. on Oct. 7. Thereafter it rose and fell with the tide in the ver, but lagged behind it in time between two and three hours, d in elevation by from 6 to 10 feet. Owing to an unusually high le on Oct. 20, the water in the shaft reached its highest elevan of 4 inches below mean sea-level, or 11·5 feet below the p of the shaft.

CONDITIONS AFTER THE FLOOD.

The Astoria shaft and 3655 feet of tunnel were now flooded with ,000,000 gallons of water. A direct connection existed between e river and the heading, capable of discharging about 12,000 gallons per minute. As the flow had increased by five times in a few minutes, its liability to further increase had to be reckoned with. The entire pumping plant at Astoria was under 275 feet of water. At the Bronx shaft, a pumping capacity of only 1200 gallons per minute was available.

Only the Bronx shaft and the northerly 974 feet of tunnel remained free from water; and this was protected only by a single bulkhead, against which a water pressure of over 200 tons was acting. The nearest point of approach to the leak was the face of this bulkhead, about 114 feet distant from the leak.

ADDITIONAL PROTECTION AND PUMPING PLANT.

While the Bronx bulkhead figured amply strong to withstand the pressure, the fact that the flooding of the entire tunnel, which would have presented a situation probably unprecedented, and would have involved immensely more difficult and costly methods of unwatering, had been escaped by the narrowest margin, caused every possible additional precaution to be taken.

Work was at once started on a vertical abutment, reinforced with rails and braced horizontally against the centre of the Bronx bulkhead [B] to strengthen it. Construction of a secondary safety bulkhead, reinforced with rails, 105 feet north of the other, located in a section of the tunnel which had been previously lined with cast-iron rings, was begun as a further protection.

As the Astoria boilers could pump only 9000 gallons per minute, and the Bronx boilers 3000 gallons (a total of 12,000 gallons), and the area in the Astoria shaft available for a float to mount pumps was limited, it was impossible to unwater the tunnel until the flow from the leak was largely shut off. A steel pontoon, specially built for mounting pumps in the Astoria shaft, and pumps of a capacity of 6600 gallons per minute were purchased. The pumping plant at the Bronx was increased from 1200 to 3000 gallons per minute—the capacity of the boilers.

During this time, and during all the operations that followed, close observations of the water-level in the Astoria shaft were plotted, together with tide-readings; and these gave quite a reliable indication of conditions in the flooded heading. At times the level of the water in the shaft closely approached, and several times even exceeded, the elevation of the river. These observations proved that there was still between the heading and the river a free connection, which must be shut-off in some way.

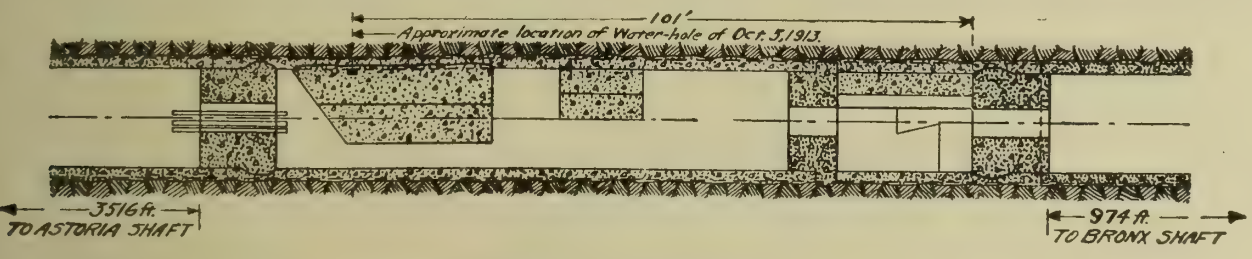
ATTEMPT TO GROUT LEAK THROUGH THE CORE BORINGS.

After discussing various methods, it was decided to first try drilling core-borings through the Bronx bulkhead and the bench, in an attempt to reach the seam at a point outside the tunnel line, and (by grouting the borings) shut off the water from the heading.

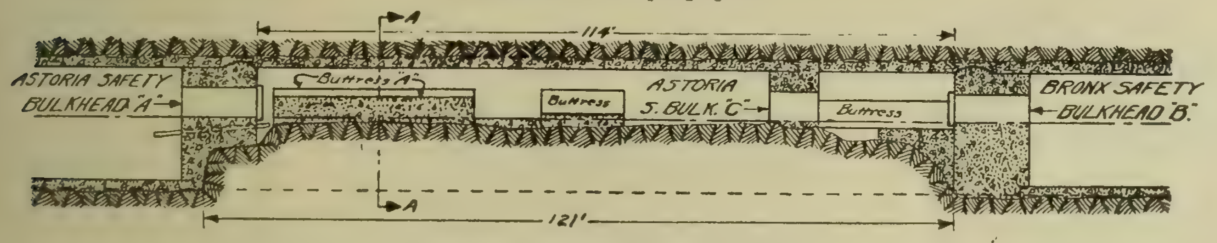
On Oct. 27, the bulkheads and additional pumps at the Bronx (to protect the Bronx shaft and the end of the tunnel against flood) having been completed, work was started drilling the first 2-inch core-boring, carefully aimed to reach the seam just outside the tunnel line and below the top of the bench. This hole was drilled a distance of 120 feet, struck water and greensand under full pressure, and was grouted with 870 bags of cement. Although it is believed that this hole entered the seam, it did not produce the desired result, as indicated by the action of the water in the Astoria shaft.

FILLING THE ENTIRE HEADING WITH CEMENT.

It was now decided to fill the entire heading between bulkheads A and B with grout, in order to stop the flow of water from the leak in the tunnel sufficiently to allow the unwatering of the Astoria shaft and tunnel. In the meantime additional core-borings were drilled with great difficulty; but very little grout could be forced into them, although water and sand with pressure were encountered, and they were not a success.



Sectional Plan on the Springing Line.



Longitudinal Section on the Centre Line.

FIG. 4.—THE CONDITIONS BETWEEN THE BULKHEADS ON OCT. 1, 1913, AFTER THE FAILURE OF BUTTRESS "A;" ALSO THE CONDITIONS AT THE TIME OF THE FLOOD ON OCT. 5, 1913, EXCEPT THAT THE BUTTRESS "A" WAS REMOVED.

In order to grout into the heading a hole was drilled through bulkhead B, and a 3-inch casing was forced through the hole and up against bulkhead C [see fig. 4]. A diamond bit was then placed on the end of a 2-inch pipe, and used as a drill-rod to drill a hole through the bulkhead C. When it was through, the 2-inch pipe was forced into the heading to a point opposite the leak. This work consumed five days. It was accomplished with great difficulties against the high pressure.

Grouting through this pipe directly into the heading to fill the entire heading with cement proceeded continuously from 3 P.M. on Nov. 10 until 4 P.M. on Nov. 12, with 400 lbs. pressure. It consumed 8600 bags of cement. This caused the water in the Astoria shaft to largely stop fluctuating, and showed that the flow was to a great extent shut off. Upon allowing water to flow from several small pipes in the Bronx bulkhead [B] to further determine conditions, water in the Astoria shaft lowered 17 feet.

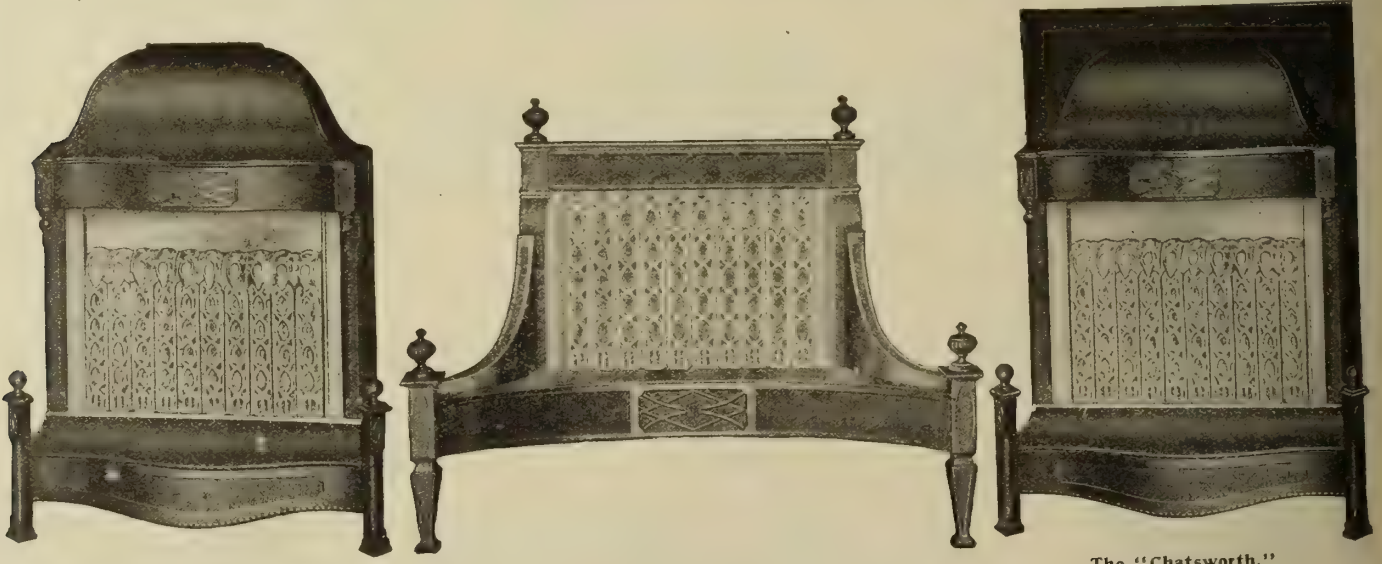
The consequent loss of pressure in the shaft and the corresponding increase of pressure from the river on the grout caused it to give way; and the water in the shaft resumed its rise and fall. Grouting through the pipe (which had been kept free) was therefore resumed on Nov. 14 and 15. When some 1700 bags had been forced in, the pressure gauge on the Bronx bulkhead exceeded the river pressure, and grout appeared through the bulkhead pipes; so grouting was temporarily discontinued. On Nov. 17 grouting was completed, with a total of 11,542 bags of cement.

This grouting caused the water in the Astoria shaft to stop fluctuating except for a few inches; and on opening pipes through the Bronx bulkhead, they gave water but no pressure. Both phenomena showed that the flow into the tunnel had been shut off. Preparations were, therefore, made to begin pumping out the Astoria shaft and tunnel.

(*To be continued.*)

PARKINSON FIRE FEATURES.

The pleasing design which has in past years been a prominent feature of the fires introduced on the market by the Parkinson Stove Company, Limited, of Birmingham, is once more found in the new patterns for the present heating season. They are, indeed, from the point of view of appearance, all that can be desired, and admirably suited to fulfil the intention with which they have been fashioned—that is, to meet the demand for gas-fires to suit modern styles of furnishing and decoration. Looking over the illustrations in the last-issued fire list of the firm—which, of course, contains, in addition to all this season's new patterns, a number of designs which have already won their way into favour—one nowhere finds evidence of any undue expenditure of time or money on ornamentation. Gracefulness has been the object aimed at, and achieved.



The "Haddon." The "Welbeck." The "Chatsworth."

NEW DESIGNS OF PARKINSON GAS-FIRES.

In the case of the three new fires which are shown here, the very reason of their introduction, as just explained, has necessitated something more elaborate in design, which has been incorporated with perfect gracefulness of line, and the elimination of superfluous metal. The "Welbeck," for a tiled recess or open hearth, is a particularly imposing fire, suitable for special positions; while the "Haddon" and the "Chatsworth" are also very handsome, but priced at a smaller figure. In all these cases, however, the "working" features are the same; and their effect is to render the fires thoroughly efficient in action, as well as good in every way to look at.

There is first of all the new pattern burner, which has several points to recommend it. From the point of view of maintenance, it is satisfactory to the gas undertakings, because of the absence of complicated parts liable to get out of order; while at the same time it meets the requirements of the consumer in the way of silent operation and a perfect flame. There are, it may be explained, cast-iron serrated conical discs introduced, which have the result of breaking-up the gas passing to the burner-jets. The space between the under side of the burner-nipple and the conical disc is large enough to allow any dust or particles of fuel which might get into the nipple to be removed without taking the burner to pieces. The burner is removable; and by merely turning it up on end, any foreign matter is discharged. The burner has been designed in such a manner that it is unnecessary to fit the injectors with air-adjusters; the regulation under varying pressures being made through the gas adjustment. The effect of this, of course, is to simplify the adjustment of the fire.

After the burner, the next important point about any gas-fire is certainly the fuel. In this respect, again, the Parkinson Stove Company for the present season indicate progress. The upright fuel itself has been considerably improved so as to give still better heating results; but, in addition to this, the application of the firm's new patent "claw" fuel renders unnecessary the use of a bar of any kind across the fuel. The "claw" fuel is placed, piece for piece, along the top of the upright fuel, which it holds firmly in position—one end of the "claw" fitting into a channel almost at the top of the fire-brick at the back, and the other over the top of the pillar of fuel. Besides the increased heating efficiency which is claimed to result from this arrangement, the "claw" piece gives an excellent finish to the fuel, which has the appearance of being in only one piece, instead of two. Between the fire-brick and the fuel, a space has been left over practically the whole of the brick; and this space allows a current of very hot air to circulate, giving as it does so a highly incandescent look to a number of studs which jut out from the brick and meet the back of the fuel. Distinct advantage, it is said, is found from the conveying in this way of heat from the fuel to the brick.

The points mentioned here, as affecting the working of the fires, should ensure for them popularity for hire purposes as well as for sale outright. And to these features, it must be remembered, has to be added the appeal that all three of the fires illustrated make to the eye. The Parkinson Stove Company's patterns for 1915-16 have been designed on the correct basis that nowadays a gas-fire must not only be good, but it must look good.

Then, of course, there is the circular gas-fire, which was introduced by Messrs. R. J. Rogers and W. E. Cadwallader, of the Birmingham Corporation Gas Department, specially with a view to meeting a requirement that had been noticed to exist in connection with the jewellery trade workshops in the city. This is being manufactured by the Parkinson Stove Company, who have given to it the distinctive name of the "Compass," because radiant heat passes from it to all parts of the compass, instead of the heat-rays being concentrated in front. With regard to this fire, there is nothing to be added to the illustrated description which appeared on p. 127 of the "Journal" for July 20 last. As was then explained, the fire is provided with a canopy that comes well over the radiants; and the flue, being in the centre, allows the products of combustion to escape freely through the proper channel. Convected heat is, of course, derived from the flue-pipe, in addition to the large amount of radiant heat from the fire, so that a high percentage of the total heat units in the gas finds its way into the room. This stove, which has a large sphere of usefulness, is fitted with a duplex burner, that allows either half or the whole of the fire to be alight.

Masonic.—At a meeting of the Provincial Grand Lodge of East Lancashire, held at Accrington on the 27th ult., Mr. J. Winson Scott, Charity Representative of the Northern Star Lodge, No. 3053, was appointed as Provincial Senior Grand Deacon by Lord Derby, Provincial Grand Master of East Lancashire.

THE INTERNATIONAL GAS CONGRESS AT SAN FRANCISCO.

[From Our Own Correspondent.]

Since 1911, when the Pacific Coast Gas Association voted to invite the gas men of the world to hold a Congress at the time of the Panama-Pacific Exposition, this Association has been tireless (against the most adverse circumstances) in its efforts to ensure the success of the Congress and the comfort and pleasure of the visiting members. The Congress is now an accomplished fact; and before describing it in detail, it should be said at once that its technical side was about all that could be expected with the international character practically obliterated by the war, and that its social side could not have been surpassed.

The attendance was over 400, of whom 100 came from the East—many from the Atlantic seaboard. In this way, the Congress has had the good result of making the two shores of our great country better acquainted.

The opening session began on Tuesday morning, Sept. 28, with an address of welcome on behalf of the Pacific Coast Gas Association by its President, Mr. E. C. Jones, who presented a gavel of California redwood with the good wishes of the Association, and as a personal souvenir, to the President of the Congress, Dr. Alexander C. Humphreys.

Dr. Humphreys, in his introductory remarks as the presiding officer, expressed the universal sympathy for all those peoples innocently dragged into war by the acts of others, and the hope that some compensating good might issue from the mountain of suffering. The war was a rebuke to the self-sufficiency that thought the present better than the past. It was humiliating to realize that the advances of science had augmented the horrors of conflict. The United States occupied a position of comparative advantage, but not of absolute security. We were, however, happy in being able to devote a few days to the advancement of our art, knowing that it had no direct application in war, and that, in general, as the efficiency of our industries was improved we were better equipped to aid rehabilitation after the war.

He continued by saying that the gas business is a complex one, presenting many problems and difficulties. The electrical industry, well guided, grows apace; and the gas engineer cannot neglect every opportunity for his own betterment. He spoke of the evils of over-regulation and legislation; the latter involving 60,000 new laws in five years. Though our Public Service Commissions are now over-developed, they are continually asking for more powers. The gas companies have been responsible for this state of affairs, in that they have not been prompt to refute falsehoods and to educate public opinion. In conclusion, he paid a tribute to Messrs. E. C. Jones and J. A. Britton for their services in bringing the Congress into being.

In the absence of Major Rolph (detained by election duties) his Private Secretary welcomed the Congress to San Francisco, which was proud of her many conventions this year as examples of the world's progress. The Gas Company was the oldest of the public service companies; and in San Francisco the gas supply represented efficiency at the highest notch, with service as the watchword.

The technical programme began with the "History of the Development of Water Gas," by Mr. O. B. Evans, of Philadelphia [see "Journal," Sept. 28, p. 705]. This, as well as all the other papers, was read in abstract only. It treats of early history and of the various methods of manufacture, past and present—retort, generator retort, Lowe, and bituminous coal systems. Some of the principles of manufacture are gone into rather fully, in the hope that the recognition of such principles may assist towards determining the possible chances of success of any proposed modification.

The Secretary of the Congress (Mr. G. G. Ramsdell) presented the paper on "Blue Water Gas and Deep Fuel Combustion," by Mr. A. G. Glasgow [see "Journal," Sept. 28, p. 705]. This states that "economy in the manufacture of water gas depends largely upon the efficient application of the principles of deep fuel combustion to the operation of air blasting." It describes the laws which obtain in deep fuel combustion, which, as commercially applied to gas manufacture, may be generally classified under four heads: Siemens or generator gas; Dowson or producer gas; simple blue water gas; and a combination process, the two examples of which are the carburetted water-gas process and the self-steaming blue water-gas process. The former process "provides the most efficient use conceivable for energy which is completely wasted in present blue water-gas manufacture." The latter process is needed to "produce simple blue water gas, *per se*, without the waste inherent in the blue gas generators hitherto used for industrial purposes." This is accomplished by utilizing the waste heat of blast products and blue water gas to produce the necessary steam.

These two papers were discussed as one. In opening, Dr. Humphreys recalled his early experiences when "blows" and "runs" of thirty minutes each were wonderfully efficient in the production of lampblack and tar. Mr. W. C. Morris, of New York, said that, prior to 1900, air and steam had been adjusted in volume to the gas made. Mr. J. M. Spitzglass, of Chicago, stated that his Company had in successful operation mechanical grates for the removal of cold clinker, but had not yet solved the problem as regards hot clinker. Dr. A. H. Elliott, of New York, reviewed his experience in the early eighties with the Tessié du Motay process, and told how, in 1878, Mr. W. H. Bradley made what years after was called Dellwik water gas. Mr. E. H. Earnshaw, of Newark (N.J.), called attention to the fact that usually the selection of fuel was not determined by a favourable ash content, and there was urgent need for investigation which would establish for different ash contents the rules of water-gas operation for best clinker control. Mr. W. A. Wood, of Boston, thought that with varying supplies of oil, the personal equation of the water-gas maker was of more value than analysis.

In closing, Mr. Evans stated that while air and steam were measured separately prior to 1907, they were not measured in combination before that time. Oil analysis was useless, and actual trials were requisite to indicate treatment when making water gas on a candle power basis. When on a thermal basis, variations in oil quality affected results less. Automatic operation of sets would reduce the peak temperature, hence clinker hardness, and this, in turn, would lead to complete clinker control.

Mr. R. S. M'Bride, of the Bureau of Standards, Washington, followed with the "Substitution of Heating Value for Candle Power as a Standard for Gas Quality." [See "Journal," Sept. 28, p. 702.] His object was "to summarize the more important principles which must be recognized in the choice of a standard of gas quality, to point out some of the errors that must be avoided in making this choice, and to outline the most desirable methods for choice of standards or for substitution of a new standard for the one now in force." He discussed the function of a standard of gas quality, the fundamentals in the relations between company and customer, and defined the conditions of a good gas supply. He considered the value of the two standards in their relation to open flame and mantle lighting, domestic cooking, water heating and room heating, industrial heating, and power production. "It is generally accepted without question that the heating value is a better measure of the usefulness of the gas." "The problem of selecting a proper standard for the heating value is primarily an economic one." "Obviously, the proper standard in any given case is closely related to the rates charged for the service." "Indeed, more and more it is being recognized that, in the adoption of a particular heating value, it is necessary to consider the question of relative costs and relative rates to the public." "Unless it is established more clearly than it yet appears to have been that a heating value materially below 600 B.Th.U. has economic advantage, there is no need to change present general practice."

In the discussion, Mr. C. O. Bond, of Philadelphia, said we did not yet know that 600 B.Th.U. was the best standard. He thought the quality should be that best suited to existing fixtures, and that uniformity of conditions throughout the country would permit consumers to carry their appliances with them as they moved. Mr. E. L. Hall, of Portland, Ore., remarked that oil gas permitted an economic variation in British thermal units from 525 to 625. Mr. G. I. Vincent, of Des Moines, Iowa, pointed out that Mr. M'Bride, in considering the inter-relation of rates and standards, neglected to mention that the varying cost of raw materials entered into this question. Mr. E. C. Jones, speaking as a maker of oil gas, preferred 600 B.Th.U. to the 550 for which at one time he had stood, if the quality could be manufactured economically and was not coupled with a candle power requirement.

Mr. H. L. Strange, of Honolulu, disagreed with Mr. Bond, and desired standards determined by local conditions. He thought few appliances were moved from town to town. He argued for selling service as well as gas. Dr. Humphreys said he altogether objected to the arbitrary determination of any standard by the government officials.

Mr. M'Bride, in his reply, said the Bureau of Standards treated all its problems theoretically, pointing out principles only—a method which has both disadvantages and advantages. He did not believe in an ideal gas. What was good for mantles might not be best in other directions. Usefulness was very well measured by heating value. The important question assuredly was, How much?

On account of the number of papers to be considered in a comparatively short time, the Congress divided into two bodies for the Wednesday morning session. Section A, under the chairmanship of Dr. Humphreys, listened to the symposium on Illumination, arranged by Mr. C. O. Bond. The latter, in a few introductory remarks, said that in the decade since the last Gas Congress, the progress made by gas in the lighting field leads to optimism for the future, and this notwithstanding the troubles still to be encountered in the perfection of lighting appliances.

Street lighting was the first subject to receive attention in "Gas Street Lighting," by Mr. G. S. Barrows, of Philadelphia. [See "Journal," Sept. 28, p. 713.] It treated of the requirements of reliability and sufficient illumination and appropriateness, and of how these are met by gas, and of the object of street lighting and means for attaining the ends sought. Attention was called to the value of appropriate designs of lanterns and posts, and photographs and illumination data of recent installations of gas-lamps were given. The utilization of high-pressure lighting was briefly referred to; and this caused Mr. L. B. Jones, of San Francisco, to speak of its far greater development in the West than in the East. Mr. Bond thought bright lights, so placed as to cast shadows towards street intersections, would be of great assistance in diminishing one of the peculiar perils of motor traffic—viz., crossing collisions. Mr. F. V. Westermaier, of Philadelphia, the Engineer of the largest street lighting company in this country, pleaded for proper maintenance. The new street lighting unit with diffusing globe was winning against electricity. The last statement was confirmed by Mr. F. A. Leach, of Oakland (Cal.), who emphasized its improved daylight appearance. Mr. J. A. Britton, of San Francisco, spoke about their perfect street lighting, with 9000 gas-lamps in 20 square miles of territory.

"Office and Store Lighting by Gas," by Messrs. Thomas Scofield and Oscar H. Fogg, both of New York [see "JOURNAL," Sept. 28, p. 713], considered briefly the modern gas units available, reviewed the major requirements which have to be met with in each class of lighting, and the advantages possessed by modern gas lighting that can be utilized in meeting these requirements. It contained fifty-two illustrations of office, store, and window lighting, accompanied by short descriptions. The pictures alone will be of great value to all having to do with gas lighting. In a written discussion, necessitated by his presence in Section B, Mr. C. W. Hare, of Philadelphia, challenged the authors' statements that candle power for candle power gas is as cool as electricity, that gas fixtures are as attractive as electric, and that long distance control of gas ignition has been made a commercial success. Answering for the authors in their absence, Mr. W. C. Morris, of New York City, contended that Mr. Hare was wrong in believing that the data given, especially as to long distance control, were based exclusively on experience with lighting maintained by a gas company in its own building; and he stood squarely for the paper as presented. Mr. C. A. Luther, of Chicago, said that they had demonstrated that heat from gas was not objectionable, by selling more arc lamps last summer than in any previous winter. For sign lighting, using one arc lamp to a letter, 80 signs requiring 400 arcs had been placed.

"Residence Lighting," by Mr. W. A. Morris, of Wilmington (Del.) [see "JOURNAL," Sept. 21, p. 654], was viewed from five standpoints: Profitability; advantage of gas over other illuminants and how to teach this to the public; satisfactory lighting for various rooms, and how it may be produced; best practices for increasing this lighting, and how to retain it. Mr. W. C. Morris thought that in residence lighting it was pleasing not to have the same colour and quality of light in every room. Dr. Elliott spoke of the circulation and purification of the air due to the use of gas, and of the accompanying avoidance of high intrinsic brilliancy. He also recommended bracket lighting. Mr. C. O. Bond referred to the use of artificial daylight for matching colours in home sewing at night. Mr. S. C. Bratton, of Portland (Ore.), said that because of the relative lack of attractiveness of gas fixtures, new houses in Portland were not being piped for gas, until he ceased attempting to get a complete system of house piping, and successfully argued only for a bracket light in each room.

"Semi-Public Lighting," by Mr. T. J. Litle, of Gloucester (N. J.) [see "JOURNAL" Sept. 28, p. 714], states that such lighting is a valuable publicity asset, that sample installations are desirable to enable the public to draw satisfactory conclusions, and touches upon the fundamental principles to be observed in obtaining good illumination in semi-public places. Indoor and outdoor lighting units are described. A great deal of stress is laid on the necessity for auxiliary lighting in all buildings apt to contain many people, to guard against the outage of the main lighting. In the discussion, Dr. Elliott noted the importance of diffused lighting, especially in the presence of good reflecting surfaces. Mr. Bond urged every one present who supplied light to libraries and schoolrooms to visit these places on their return, as it was the peculiar duty of the lighting company to ensure good lighting there, and thus preserve the vision of the youth of the nation.

In "Industrial Gas Lighting," Mr. R. F. Pierce, of Gloucester (N.J.) [see "JOURNAL," Sept. 28, p. 714], says the illumination of factories is a particularly fertile field for the sale of gas on the score of economy. Manufacturers are being speedily aroused to the economic benefits of good lighting. A recent investigation showed that lighting changes in 164 factories had improved the quantity or quality of output in 91 cases. Accident insurance reports indicate that faulty illumination is responsible for a large proportion of industrial accidents. In order to secure marked beneficial results from the remodelling of a lighting system, it is necessary to ensure the avoidance of eyestrain, to observe proper spacing relations, to select proper size of lighting unit, and to provide the right intensity of general and local illumination as circumstances require. All of this generally demands the attention of a specialist.

Mr. C. W. Hare, in another written discussion, joins issue with Mr. Pierce, and thinks that factory lighting does not have a high load factor, that the maintenance cost of such lighting is higher than for residences, that the cost comparison must have been made with electricity under old conditions, and that pilot consumption should not have been ignored. Mr. Bond thought Mr. Hare pessimistic. If the latter had been present, however, he undoubtedly would have replied that a selling experience of six years qualified him to know of the actual troubles experienced in the hands of consumers with certain lighting appliances, which others might see only under more favourable auspices.

"Buoy and Car Lighting," by Mr. G. E. Hulse, of New York City, "describes the use of Pintsch gas and acetylene for the lighting of railroad cars and aids to navigation. It gives a brief history of the application of these gases to these purposes, the reasons for their special advantages for this work, the method of manufacture of each, the equipment used, including types of burners, and the illumination and service results obtained." The paper, although thought necessary to round off the subject of gaseous illumination, treated of a field foreign to most of the audience. Dr. Elliott and Dr. Humphreys both indulged in reminiscences connected with the early development of Pintsch gas in this country. Dr. Humphreys, in closing the session, went back to the years not so far away when the photometer was regarded as the only measure of a light's value. He considered the session very important because of the emphasis placed on the many improvements in illumination.

Section B was called to order by Mr. E. C. Jones, who shortly afterwards relinquished the gavel to Mr. C. W. Hare. The section listened to a symposium on "Some Commercial Aspects of the Gas Business," presented on behalf of the National Commercial Gas Association. It consisted of papers arranged for by a Committee, of which the Chairman was Mr. Hare. They were as follows: "Commercial Policies," C. W. Hare; "Public Relations," E. N. Wrightington; "Office Management," C. N. Stannard; "Orders and Complaints," W. J. Clark; "Accounting," P. S. Young; "Domestic Fuel," R. E. Slade; "Domestic Lighting," J. D. Shattuck; "Commercial Lighting," E. M. Colquhoun; "Industrial Fuel," F. W. Frueauff. [Abstracts of these papers were given in the "JOURNAL" for Sept. 21, pp. 653-655.] The discussion was quite lively at times; and it is to be regretted that the impossibility of being in two places at once should deprive this account of the comments made.

"Commercial Policies" states that the gas industry was slow to realize the importance of its commercial side; and it is due largely to this past attitude towards the public that unusually intensive business methods are necessary to-day. It advocates voluntary price reductions as fast as justifiable. It argues for national effort in addition to local endeavours, for the reason that such national effort is essential to the fullest local benefit.

The author of "Public Relations" starts out by saying: "It is only by active and aggressive methods of business solicitation, combined with a sincere effort to perfect the service and give the customer the most for his money, that the fullest returns to the business can be secured." This involves making each customer feel his patronage is of concern to the company, square and tactful dealing throughout, and taking the public into confidence as to acts and earnings—showing how the latter represent but a fair interest on money invested.

"Office Management." The ideal office will have an efficient manager, organization charts, a system of internal communication, standard forms, and proper discipline, based largely on personal talks. The desk arrangement will be such that the public will ordinarily pass the appliance display.

"Orders and Complaints." This is concerned with "good service" in caring for these orders. As it is here that the company comes most frequently in direct contact with the public, its representative should be of proper calibre, and always able to take the consumer's point of view. Promptness of remedy is also insisted on.

The paper on "Accounting" draws attention to the main functions of the subject, its past accomplishments in the gas business, and what it may reasonably be expected to do in the future. It argues for the development of standardized methods and processes, and the proper selection and education of the accountant.

The author of "Domestic Fuel" believes that the greater use of gas-ranges in the winter months will be a large factor in future increased gas sales. To obtain this winter use, means for heating water and the kitchen are needed, and are described. The sale of gas for auxiliary house heating is advocated; but attention is called to the possible undesirability of this consumption if it adds to peak-load. The gas-iron and garbage incinerator are mentioned among the desirable appliances to increase output.

The author of "Domestic Lighting" considers his subject in its relation to the gas industry to be one of the most interesting, as well as one of the most important, problems of the present time, for a large proportion of the gas is sold for lighting; and this use is least affected by business depression. Better and more attracting fixtures and a broad maintenance service are essential to keep gas in the lead in the lighting field.

In the paper on "Commercial Lighting" the author remarks: "The advantage of economy in operating costs that was formerly so beneficial to the gas industry does not exist to the same extent to-day." Therefore, "to increase the commercial lighting use of gas, the cost of operation must be reduced." A method of ignition more economical than the pilot light is needed. There must be the best maintenance service at the lowest possible cost to the consumer.

"Industrial Fuel." The author considers this branch of the gas industry is of vital interest, because of the present profitable return as well as the great future possibilities. For the best development, proper wholesale gas rates, adequately trained salesmen, and highly efficient large appliances are all required, and to obtain the latter a central testing laboratory, supported by the gas companies, is advocated.

The last session of the Congress was convened on Thursday morning. The first paper was "Modern Carbonization Systems in America," by the Society of Gas Engineering of New York City [see "JOURNAL," Sept. 28, p. 702]. This contained 20 pages of tabular data and 27 double-page illustrations from 19 modern carbonizing systems of various types. From these certain conclusions are drawn that, for lack of space, must be sought in the paper itself, which makes easily available information of value to all manufacturing engineers.

Mr. W. C. Morris said that he had assumed certain arbitrary figures, and applied them to the data, with the following result:

	Cost of Plant per 1000 Feet of Daily Make. $	Cost of Gas per 1000 Cubic Feet. Cents.
Stop-ends	99·00	17·48
Throughs	70·00	12·83
Inclines	72·00	12·56
Verticals	88·00	11·97

He considered these figures showed that if one already possessed an efficient installation of one of these systems, it generally would not pay to change.

Mr. C. H. Nettleton, of New Haven (Conn.), stated that his vertical installation was still in an experimental stage; but he had no doubt of the outcome. They had obtained a larger yield in candle-feet at a temperature of 2400° Fahr. than at 2200° Fahr. Mr. Bond thought the gas industry must learn to take a broader view, go back to the mine mouth, and see that coal is utilized with the least possible waste.

Then came the only international feature of the programme—a symposium of papers sent as a contribution from the Institution of Gas Engineers of Great Britain, collected by one who, as he gathered them, was called from his labours, and to what these were, the "JOURNAL" columns have borne full testimony. Little wonder there was a hush over the audience at the announcement of Mr. Edward Allen's introduction to "A Review of the Present Practices in the Manufacture and Distribution of Gas by British Undertakings" [*ante*, p. 79]. It was read by Mr. E. C. Jones as a tribute of love and respect to the author. After this, the papers of the symposium were read in abstract—viz., "Condensation, Washing, and Scrubbing of Coal Gas," by Dr. W. B. Davidson; "Purification of Coal Gas," by Mr. J. Ferguson Bell; "Distribution," by Mr. Walter Hole; and "Sale of Gas," by Mr. F. W. Goodenough. No synopsis of them will be given here, for they describe matters well known to "JOURNAL" readers, who probably also have had ere now the opportunity of reading the complete papers. [See "JOURNAL," Sept. 28, pp. 699-701.]

The Secretary was directed to cable the thanks of the Congress to the Institution of Gas Engineers and its sympathy to Mrs. Allen. At this moment of fraternal feeling, Mr. Walton Forstall, of Philadelphia, asked permission to read the inspiring words with which Mr. Goodenough concludes: "May we long go forward side by side, mutually stimulating and encouraging each other, believing, with Robert Louis Stevenson, that 'an inspiration is a joy for ever, a possession as solid as a landed estate, a fortune we can never exhaust, and which gives us year by year a revenue of pleasurable activity;' and so travel hopefully together towards the unattainable ideal of perfection, in the service of the public and of the great industry in which we are engaged."

In the discussion which followed, the subject of high-pressure distribution was first brought up, and in the few moments available before final adjournment it was the only one considered. Mr. E. C. Jones said that welding was not possible on a main containing gas under high pressure, but was often done where there was low or no pressure. Mr. E. H. Earnshaw, of Newark (N.J.), spoke of many thousand consumers in small towns supplied directly from high-pressure mains, through individual house governors provided with a mercury seal. Mr. K. L. Simons, of El Paso (Texas), had found under rapid temperature changes that the leather in the governor diaphragms was affected, and the outlet pressure got too high. Mr. D. E. Keppelmann, of San Francisco, supplies from mains carrying 40 to 100 lbs., but uses an oil seal, which is as effective as, and much more economical than, mercury, and the outlet pressure does not change. Mr. H. L. Strange, of Honolulu, has 5000 consumers on lines carrying 4 to 30 lbs., has no trouble with outlet pressure, and uses no seal. Mr. E. C. Jones, in bearing testimony to the reliability of high-pressure distribution, remarked that his experience dated from 1902, and now covered 100 miles of pipe, carrying 5 to 150 lbs.; and he had known only one seal to blow. Mr. E. G. Cowdery, of Chicago, in twelve years had known of no governor troubles. Mr. J. H. Maxon, of Muncie (Ind.), believed in the future of high pressure. Natural gas was conveyed under 1200 lbs. pressure, and house governors used on 300-lb. supplies.

The thanks of the Congress were voted to the individuals and societies preparing papers, to the officers of the Panama-Pacific Exposition, and to the Pacific Coast Gas Association, though it was felt that no written words could adequately express the courtesies received from, and the enjoyment due to, the untiring efforts of the latter Association.

With this the technical curtain falls; and the play, while not all that was at one time hoped, was yet quite worth while, and when the information gathered off-stage is considered, no visitor should regret the journey.

From the social side, as has already been indicated, nothing was lacking. Monday night there was a reception to Dr. Humphreys, with professional and miscellaneous dancing. On Tuesday, the ladies were taken over the city in the morning and to the Exposition in the afternoon. On Tuesday evening, men and women visited the "Joy Zone," where they saw the low-pressure gas-lamps lighting its streets. On Wednesday, the ladies were taken for luncheon to the famous Cliff House on the Golden Gate, and then, *vid* the parks, to the Exposition. On Thursday, which was Gas Congress Day at the Exposition, every one went in the afternoon to Festival Hall to listen to an address of welcome by Mr. Britton, followed by the presentation of a bronze medal to the International Gas Congress by Mr. C. C. Moore, the President of the Exposition. This was suitably responded to by Dr. Humphreys. Then, as was peculiarly fitting to a gathering of gas men, Mr. W. D'A. Ryan showed, with coloured lantern slides, the "Illumination of the Panama-Pacific International Exposition." This served in a slight way to prepare the way for Mr. Ryan's personally conducted trip through the lighted avenues the following evening. The exercises of Thursday concluded with a dinner at the Inside Inn, and a dance at the California building.

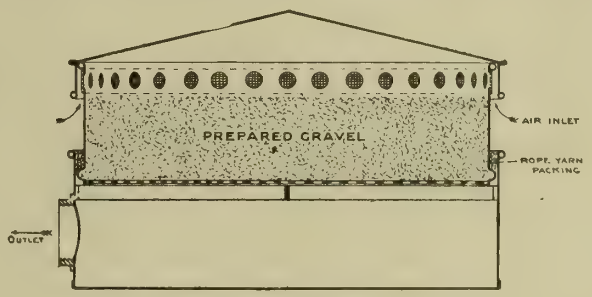
On Friday afternoon, all were the guests of Mr. Strange, representing the Honolulu Gas Company, at an entertainment in the Hawaiian exhibit. In the evening for two hours, beginning with a wonderful display of fireworks, supplemented by coloured searchlights thrown on smoke and steam, the enchanted pilgrims followed, first by small tramcars and then on foot, the hurrying—there was much to see—steps of Mr. Ryan, who, like a modern Pied Piper, led on from one glory to another, until the mind was wonderfully crowded with beautiful images of magnificent buildings perfectly lighted, and where colour, form, and, above all, reflection from liquid mirrors combined to appeal to the higher things of the spirit.

Thus the Congress ended with a fitting climax; and all of those privileged to serve the public in the gas industry should bring from San Francisco renewed zeal in striving for a goal which, when reached, will mean the universal prevalence of good lighting, and which has certainly been brought nearer by the Exposition—a revelation to the general public of illumination without glare.

FILTERS FOR AIR COMPRESSORS.

WHEN making use of rotary blowers or compressors for air, the James Keith and Blackman Company, Limited, point out, it is necessary to ensure that the air supply is as pure and free from dust or dirt as possible. Unless this precaution is taken, the compressor is liable to suffer from undue wear or other derangement—the dust or grit drawn in mixing with the lubricant and forming a grinding material. To obviate this trouble, the inlet-pipe should be led to a point where the least possible amount of dust is likely to be drawn in.

It is desirable, however, they say, in addition to this, to fix an apparatus which will efficiently screen the incoming air. It is obvious that a simple screen will not entirely meet the case, as it will not prevent the passage of fine dust which is gradually absorbed by the lubricant with the above results. The firm have therefore designed a filter so as to overcome this difficulty. It consists of a circular metal container carrying in its upper portion a tray with perforated bottom. The tray is charged with small, or "pea," gravel, treated with some sticky medium such as diluted molasses or ordinary golden syrup. The incoming air passes over, and through, this bed of material; and all dust and dirt are eliminated by adhering to the sticky gravel. From time to time the gravel can be washed and re-charged with molasses. The joint of the tray with the container is made with a piece of rope yarn, so that for cleaning purposes there is no necessity to break the pipe-joint. The filters are suitable for all classes of air-compressors, and are made in three standard sizes of 12, 18, and 24 inches diameter.



The Keith Air-Filter.

Natural Gas in the United States in 1914.—The utilization of natural gas in the United States, "Engineering" points out, exceeded in the year 1914 that of any previous year—the total of 591,866,733,000 cubic feet, valued at $94,115,524, being 2 per cent. larger than that of 1913. The increase was particularly large in California, which produced 7000 million cubic feet more gas than in the previous year. There were also increases in New York, Ohio, Oklahoma, Texas, Louisiana, Alabama, and Iowa; while the production of Pennsylvania decreased decidedly by 10,000 million cubic feet. The statistics were compiled by Mr. J. D. Northrop from the United States Geological Survey. The great increase in California was mainly due to the domestic demand for gas; elsewhere developments of new sources and new industries and stimulated drilling account for the rise. About one-third of the total gas produced in the year was utilized in houses. The average price paid by domestic consumers was 28·04 c. per 1000 cubic feet; the average charge for industrial gas was 9·58 c.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting in Manchester.

The One-Hundred-and-Seventy-Third Quarterly Meeting of the Manchester District Institution of Gas Engineers was held at the Grand Hotel, Manchester, on Saturday; the gathering being the last under Mr. J. G. Newbigging's memorable two successive years in the presidential chair. There were 105 acceptances for the meeting; and the figures disclosed by the signatures in the Visitors' Book at the Bradford Road Gas-Works showed that over 80 per cent. of the members had availed themselves of the invitation of the Chairman (Alderman W. Kay, J.P.) and members of the Gas Committee of the Manchester Corporation to inspect the toluol extraction plant, the chemical works, and other interesting developments now being carried out there. The members were conveyed from the centre of the city to the Bradford Road works in special cars generously provided by the Gas Committee. A description of the works will be found on p. 248.

Visit to the Bradford Road Gas-Works.

On arrival at the works the parties were warmly welcomed by Alderman Kay; Mr. John Harrison (Chairman of the Bradford Road Gas-Works Sub-Committee); Alderman Burtles, the Vice-Chairman; Mr. J. G. Newbigging, M.Inst.C.E., the Chief Engineer, Manchester Corporation Gas-Works; Mr. Fredk. A. Price, the Superintendent of the Gas Department; Mr. J. R. Hill, the Manager of the Bradford Road Station; Mr. J. Taylor, the Deputy-Manager; Mr. A. L. Holton, the Work's Superintendent; and several assistants. Here, light refreshments were served, after which the members broke up into different groups—being subsequently "personally conducted" round the works by one or other of the gentlemen already named. After a profitable ninety minutes, the party returned to the city in the special cars.

The Luncheon.

Arrangements for over 100 members and guests were made in the restaurant of the Grand Hotel, where luncheon was served at a number of small tables.

The repast over, and the Loyal Toast having been duly honoured on the proposition of the President,

Tribute to the Manchester Gas Committee.

Mr. E. A. Harman said the toast he had now to propose was one which would, he felt sure, commend itself to every member of the Institution. On certain occasions many of them had doubtless found that, no matter what they had intended to say, there had always been something left unsaid, notwithstanding careful preparation for it. Something akin to this feeling took possession of him at the moment; they had so many times received the hospitality of the Manchester Corporation Gas Committee that the task of finding something new to say by way of expressing thanks was a difficult one. He need hardly remind the members that this was the second year in succession in which their President had been elected to his high office, and on each of these occasions the Manchester Corporation had kindly allowed the members of the Institution to visit one of their works. They had that morning had the priviledge of inspecting the Bradford Road Gas-Works; and he had no hesitation at all in stating, on behalf of his fellow-members, that they regarded the works as a monument of engineering skill. Not only this, but they were of an educational character to many of them; and this was very real work of great value. They had that morning seen one of the finest plants in the country for the extraction of toluol. He had inspected several plants, but had never seen a better one than that at Bradford Road. They had also had the rare opportunity of seeing sulphuric acid plant capable of making about 100 tons of chamber acid a week. He was very glad to see this new feature, coming as it did at a critical time in the Nation's affairs; for they saw how the Manchester Corporation had solved an important problem at home, and encouraged home industries. The plant, really, was of a very beautiful character. Over and above this, however, had been the generosity, courtesy, and kindness extended to them on this and other occasions by the Manchester Gas Committee. With the name of the Manchester Gas Committee he must, of course, couple its distinguished Chairman, Alderman Kay, J.P., whose name was known not only in Manchester, but all over the country, for the energetic way he had taken in hand important matters vitally affecting the welfare of the industry to which they were all so proud to belong. He might even go further than this and say that Alderman Kay's name was known wherever the purification and distribution of coal gas was carried on. He had had the honour to be associated with Alderman Kay on an important Committee—the Sulphate of Ammonia Committee—in which he had rendered services of the utmost value to the whole industry. The work of the Committee was of vast importance; and, in addition, other Associations had claims upon him—the British Commercial Gas Association, for instance, which he had supported with great enthusiasm for the extension and good of the gas industry. They were delighted to see, also, Councillor Harrison, the Chairman of the Bradford Road Gas-Works Sub-Committee, and Alderman Burtles, the Deputy-Chairman, and glad to have them at their gathering that afternoon. They were also pleased to welcome Mr. F. A. Price, the Superintendent of the Manchester Gas Department. When mentioning these names a good deal more might have been said had time permitted, but it did not. He, therefore, proposed with very great heartiness that the best thanks of the Manchester District Institution of Gas Engineers be tendered to the Manchester Corporation Gas Committee for having kindly permitted them to inspect the Bradford Road gas undertaking that morning, and with the toast of the Committee he would couple the name of Alderman Kay, the Chairman.

Mr. W. Whatmough (Heywood), the Junior Vice-President of the Institution, said it afforded him much pleasure to second the vote of thanks. They all knew very well how the Manchester Gas Committee had extended to them hospitality during the past two years, and they were greatly indebted to them for it. Adverting to a remark regarding Alderman Kay's enthusiastic support of the British Commercial Gas Association, he only wished that some of the corporations who had already joined could be imbued with the same spirit as Alderman Kay had shown in connection with the Manchester gas undertaking. He (the speaker) felt it very desirable that all corporations should come in. Alderman Kay's action was worthy of emulation; and he trusted that those corporations who had not yet come in would shortly do so.

The President's Testimony.

The President, in putting the vote of thanks, said he would like to have the opportunity of supporting it in his official capacity. Whatever success the Institution had attained during his term of office was due largely to the support he had had from the Gas Committee, who had always been pleased to allow the members to visit the works, and freely see anything that they had of interest to show. Of course, in a large works like theirs they could naturally show a greater variety of apparatus than in a smaller works; but he wanted to emphasize the point that whatever success he had had during his term of office was due to the way in which Alderman Kay, his Chairman, and his Committee, had helped him.

The toast of "The Committee," coupled with the name of Alderman Kay, having been enthusiastically honoured,

Alderman Kay, in replying, said the proposer and seconder of the toast had been more than generous in their appreciation of himself and his colleagues. Mr. Harman had alluded to the "generosity of the Gas Committee" to the members of the Institution. He (Alderman Kay) assured them that it had been a pleasure, and, moreover, somewhat of a duty they owed to the industry and themselves, because he always held that interchanges of opinion brought about by technical gatherings like these could have but one result—for good. After a reference to the patriotism of gas engineers generally and their unstinted energies in certain directions, Alderman Kay went on to say that on an occasion when he visited Germany, in company with Mr. Newbigging, they saw for themselves the extensive bye-product recovery plants, not only in gas-works but in coke-oven and steel works. The time had, however, now passed when Britishers would be content to wait for a lead. They were surely "waking up." It was a regrettable fact, but nevertheless true, that ten years ago in Manchester it was possible to see gas-engines running of 4000 H.P. type, but to-day there were very few indeed of 1000 H.P. running successfully in the country. We should cast away our insular prejudice to the use of the gas-engine. He concluded by stating that he was particularly pleased to see so many members present from smaller undertakings, and to have been able to have given them the opportunity of seeing what it was possible to accomplish in a large gas-works. So long as he was Chairman of the Manchester Gas Committee, this spirit of welcome towards the younger members would be fostered and encouraged. Speaking of the work of the future, he was convinced that, although a lot had been achieved in the past, a great deal of the success of the future was wrapped up in the question of cheaper gaseous fuel. In this connection he referred in condemnatory terms to gas departments being called upon to contribute vast sums of money every year to the relief of the rates. He had previously referred at length to what they had done in Manchester in this respect. The Gas Department there had grown by leaps and bounds—far beyond the ideas of many of them; but there was still plenty of other work to do. For instance, he could not imagine for a moment how it was possible to better generate electricity other than by gas—that was a case where the two industries could run side by side with satisfaction to both undertakings. It had been a great pleasure to him to support Mr. Newbigging in his efforts to interest the members that day; and if the Manchester Gas Committee had been able to afford them any interest and entertainment, it had been a great pleasure to welcome them again to the city on behalf of the Corporation.

The Business Meeting.

The business meeting of the Institution was subsequently held, Mr. J. G. Newbigging (the President) in the chair.

Minutes of Last Meetings.

The President said he was very pleased to see such a large number of members at the meeting, because the two subjects hey were to discuss, "The Dehydration of Tar" and "Toluene" xtraction, would be particularly helpful to all in the work hey were engaged in as the *quota* of the gas industry towards he termination of this terrible war in the Allies' favour. He sug-ested that the members should agree to take as read the minutes f the last meeting [Feb. 27] and of the special meeting [April 13] ealing specially with toluol and coal supplies. He asked them o adopt this course as they had a long *agenda* to get through.

The members agreed, and the minutes were taken as read, on he proposition of Mr. Samuel Glover (St. Helens), seconded by Ir. H. Kendrick (Stretford).

The Late Mr. Edward Allen.

The President said the next item on the *agenda* was the orrowful part of their business that day. They had to mourn he death of a much-esteemed and valued member of their Insti-ution in Mr. Edward Allen, of Liverpool. Mr. Allen possessed disposition which made many friends and no enemies. He orked untiringly in many directions on behalf of the gas industry; nd there was little doubt the strain of his work in connection ith the High Explosives Committee hastened his end. They at Ianchester were looking forward to his occupancy of the chair f the Institution, and of the proceedings to which he had con-ributed much valuable written and verbal matter on various opics. "Your Committee," concluded Mr. Newbigging, "have lready forwarded a letter of condolence to Mrs. Allen, to which e have had a very touching reply. Before asking you to express his, I shall be glad to give members the opportunity of paying a ribute to Mr. Allen's worth and memory." Mr. Newbigging pro-eeded: "Gentlemen, we will be upstanding to pass this silent ribute to Mr. Allen's memory."

The Late Mr. Bower and Professor Vivian B. Lewes.

The President said they had also lost since their last meeting wo other gentlemen prominently connected with the gas industry. Ir. Thomas Bower, of West Hartlepool, was a very old member f the Manchester Institution—having been elected as far back s 1878. He removed over twenty-five years ago to West Hartle-ool, so they had not seen him at their meetings. Still, he was a ery valued member and highly respected, and did good work in e North of England Association. Then—as all knew—only week ago that day they lost Professor Lewes under somewhat agic circumstances. He (the President) thought the least they ould do was to speak of him at this meeting. They all knew rofessor Lewes very well, and what yeoman service he had done r the gas industry in text-books, writings, and lectures. He as sure they would all miss the genial Professor. He (the Pre-dent) proposed that votes of condolence be sent to the families, nd he asked the members to rise with him as a mark of their ympathy with the relatives.

The members agreed to the suggestion by upstanding in silence.

Letters of Apology.

Mr. G. S. Frith, the Hon. Secretary, said letters of apology r non-attendance had been received from, among others, Alder-an T. Hassall, J.P., Deputy-Chairman of the Manchester Gas ommittee, and Mr. T. Waddom, of Newcastle-on-Tyne.

Election of New Members.

The President said he had now the pleasure to welcome eleven ew members to the Institution. He was gratified to see such fairly good list. He had much pleasure in welcoming each of em to the Institution. The first duty which devolved on new embers of the Institution was to consider the titles of the papers ey would read to the Institution. [The following are the names f the new members elected: Messrs. J. E. Blundell, Macclesfield; . Chadderton, Barrow-in-Furness; H. H. Collett, Meadow Lane as-Works, Leeds; R. E. Gibson, Assoc.M.Inst.C.E., Liverpool; . C. Handley, Whitworth Vale; J. K. Law, Marple Bridge; . M'Nicholl, Mossley; W. J. Smith, B.Sc., Bolton; Julian tephenson, Bingley; T. H. West, Lymm; and J. T. Wood, nutsford.]

Appointment of Scrutineers.

Mr. William Jonas, of Earby, and Mr. Charles Loveridge, f Wolstanton, were appointed Scrutineers on the election of fficers.

The Dehydration of Tar.

Mr. E. V. Chambers (of the firm of Messrs. Hird, Chambers, nd Hammond) then delivered his paper, entitled "The De-ydration of Tar," which, with the discussion, will be found on age 261. Prior to his arrival, however, the paper was being read y the Hon. Secretary (Mr. G. S. Frith).

Thanks to Mr. Chambers.

After the close of the paper,

Mr. Chas. Wood, F.C.S., of Bradford, said he had great pleasure proposing the best thanks of the Institution be given to Mr. hambers for his most interesting paper. He was quite sure ey could not know at the present time too much about tar. Iany of them, perhaps, had no opportunity of knowing much bout it except that it was a nuisance at their works; but there as no doubt a great deal for them to learn about tar in the future. le was quite certain that in the future large quantities of tar ould be required. He had listened with very great interest to Ir. Chambers's paper, and was sure their heartiest thanks were ue to him for it.

Mr. J. W. Morrison, M.Inst.C.E. (Sheffield), who seconded, said the author of the paper had given them a very excellent argument to put before the tar distillers. They would now be able to say to the distiller: "Are you prepared to give us the figure that the writer of the paper says he can do?" Many works where tar was not distilled got as good results as those who did. They were at any rate one of them. But he would now turn his attention to the making of tar for road-making purposes. What they had heard was food for reflection. He thought there was something in what Mr. Chambers had said; and they must now see whether they could prove it or disprove it.

Mr. Chambers briefly acknowledged, and said he very much appreciated the interest the members had demonstrated in his paper. This was the first time he had addressed a meeting on the tar question; and he assured the members how much he appreciated the opportunity of bringing the subject before such an important section of the gas industry as the Manchester Institution.

Report of the Scrutineers on Election of Officers.

The Scrutineers presented their report on the election of officers, which showed the following had been elected:

President.—Mr. Edward A. Harman, M.Inst.C.E., Huddersfield.
Vice-Presidents.—Mr. Walter Whatmough, Heywood; Mr. J. P. Leather, Burnley.
Hon. Treasurer.—Mr. James Braddock, Radcliffe.
Hon. Secretary.—Mr. G. S. Frith, Runcorn.
New Members of Committee.—Mr. A. Morton Fyffe, Blackburn; Mr. W. B. M'Lusky, Halifax; Mr. Samuel Tagg, Preston.
Auditors.—Mr. Charles Potts, Hyde; Mr. William Hill, Stalybridge.

Mr. Harman as the New President.

The Retiring President (Mr. Newbigging) said he had the greatest possible pleasure in congratulating Mr. Harman on having been unanimously elected as President of the Institution. He was sure that he richly deserved the honour which had been conferred upon him. He had been most useful to him (the outgoing President) in many ways during his term of office, and of very great assistance in carrying the work on during the last two years. He (Mr. Newbigging) hoped to be able to assist Mr. Harman, as he had so willingly assisted him. He sincerely congratulated him.

Mr. Harman said he desired to thank the members for the honour they had conferred upon him that day. He felt that this was hardly the right time for him to express his views very fully. He promised them, however, that he would do his utmost to uphold the high traditions of his office. Had he been consulted in the matter, he would have wanted something in the form of an accidental buffer to have come between the outgoing President and himself, with an interval of a couple of years between Mr. Newbigging and himself. It was, however, "something of a come-down" to step into the position vacated by Mr. Newbigging and his "make" of so many hundred millions a year, to him with a "make of nothing a year." [Laughter.] He could not promise to carry out the duties so splendidly as Mr. Newbigging had done for the last two years; but he would endeavour to do his utmost. He thanked the members most heartily.

The Construction of the Committee.

Mr. J. H. Brearley (Longwood) asked whether he would be in order to refer to the names of the Committee. He hoped it would not be forgotten that there were a large number of members of the Institution who were in charge of comparatively small gas-works; and if these members did not send in their names for nomination, he hoped the Committee would see that their names were not overlooked. They were, as they all knew, members who were managers of the smaller undertakings whom they felt it only right they should occasionally honour. It was not always possible for the smaller engineers to participate in the higher honours of the Institution of Gas Engineers; but they should have the opportunity of being represented on the District Institutions. He had not one word to say against the selection of the three gentlemen who had been elected to the Committee. This was far from his object. No doubt, they were all very estimable gentlemen, and would prove a decided acquisition to the Committee. But some of them were, he thought, comparatively new to membership of the Institution. Twelve months ago, he (the speaker) went to the works of a member making 60 millions a year, and asked him to accept nomination. He agreed to do so. The Committee, however, in their wisdom, nominated several more members, and his friend did not get elected. This year there had been no election. He ventured the opinion that it was not always the wisest policy to elect for the Committee members of large works, and of comparatively recent election as members. He hoped the Committee would have an eye to the interests of the members who managed small works.

The President (Mr. Newbigging): "Quite right. There is nothing like criticism." Since he had been connected with the Institution, continued the President, the size of the works had never influenced him one iota. They had, however, this year (as the list would show) one or two new members who happened to be in charge of large works. If the members would look back to the "Transactions," it would be found that in other years they had elected members of smaller works on the Committee. He (Mr. Newbigging) was quite convinced that there were many good men in charge of small works to-day, as also there were in large works. He was glad, however, that the point had been raised, and it would not be lost sight of. It was, in fact, very necessary that it should be borne well in mind.

TOLUOL.

The members discussed this matter privately; and this informal conference occupied a great length of time.

The proceedings closed with a hearty vote of thanks to the Chairman and members of the Manchester Corporation Gas Committee for their kindnesses during the past two years.

SPONTANEOUS IGNITION OF COAL.

The following is a summary of a recent communication to the "Journal für Gasbeleuchtung," on the spontaneous ignition of coal, by Dr. R. NÜBLING and HERTA WANNER, of the Stuttgart Gas-Works.

Dennstedt and Bünz studied the behaviour of coal in a stream of oxygen at 275° to 302° Fahr. They ascertained that the tendency of the coal to heat-up increased with the temperature and with the concentration of the oxygen, and predicted that the tendency to spontaneous ignition was connoted by the rate at which the temperature rose. They ranged coals in four classes according to the rise of temperature observed. They also established that the water of constitution in the air-dried coal increased with the liability to spontaneous ignition; that inorganic constituents, such as pyrites, played no part; and that the more inflammable coals contained little available hydrogen. A relation was established as between the quantity of constituents extractable by certain organic solvents and the tendency to spontaneous ignition, as well as between the latter and the friability of the coal. That portion of the coal substance which was derived from the cellulose of the original wood, and was insoluble in organic solvents, produced humic acids on further oxidation; and these were chiefly responsible for the spontaneous ignition. They contained a preponderance of unsaturated compounds, of which the iodine number, showing the absorptive capacity for iodine, was a measure. The Maumene number, which shows the rise of temperature on treatment by sulphuric acid, was also an important indication of liability to spontaneous ignition.

The authors used a modification of Dennstedt's apparatus, consisting of a copper bath, 24 inches long, nearly 5 inches wide, and 8 inches high, filled with paraffin. A tube of ⅜-inch bore passed through the middle of the bath to a pipe at the back of the bath, 8 inches long and nearly 3 inches bore, which pipe was well insulated. After the coal to be examined had been passed into the wide pipe, it was closed by a perforated disc of asbestos, and the thermometer was inserted. Solvents or other volatile matter were driven off from the samples in a stream of dry carbonic acid; the temperature being maintained at 18° Fahr. above the boiling point of the solvents. Oxygen was then admitted, and the effect on the sample noted.

Westphalian coals, known to be prone to spontaneous ignition, were examined and compared with still more inflammable Yorkshire coals, and a Saar coal, which, through storage, had ceased to be dangerous. The coals were reduced to fine powder and not exposed to the air longer than need be. The smaller the quantity of coal taken for the test, the higher was the observed temperature of ignition. Consequently, very small quantities were not used. Each test was repeated four times, in order to reduce errors of observation.

The procedure with each coal was as follows: The temperature of ignition of a 20 gramme portion was observed; then 40 grammes of the coal were extracted with ether and the temperature of ignition of the residue after extraction was observed. Similarly 40 gramme portions of the coal were extracted with glacial acetic acid, acetone, chinoline, and pyridine, and the temperatures of ignition of the residues from such extractions were observed. In order to obtain quantities of the pyridine extract for experiment, and at the same time to avoid possible changes in the extract due to heating, 50 to 100 grammes of the coal were mechanically agitated for some days with 200 to 400 c.c. of pyridine. The pyridine was then drawn off and the residue washed twice with small quantities of fresh pyridine and then repeatedly with ether. The filtrate was collected in a large beaker, and 1½ to 3 litres of ether were added to precipitate the coal extract. The precipitate was washed with ether, and the ether and the greater part of the pyridine driven off by heating in a vacuum to a temperature not exceeding 80° C. This treatment of the pyridine extract was repeated, and the temperature of ignition of the final extract was observed.

Ultimate analyses were made of the residue from the pyridine extract and of the extract itself. The bromine absorption of the coal itself, of the pyridine extract, and of the residue from the pyridine extraction, was determined in the following manner: Five grammes were agitated in a small beaker with 10 c.c. of chloroform, and standard bromine was added drop by drop. The end of the absorption was ascertained by means of narrow strips of filter paper, which showed a pale yellow edge as soon as the bromine absorption was completed. The pyridine extracts contained no sulphur and little nitrogen.

The authors consider that further experiments are necessary in order to determine what constituents of the pyridine extract are the active bodies in causing spontaneous ignition. The principal results of their observations on the three samples of coal referred to are given in the annexed table.

Chief Results of Investigation of Three Coals.

Class of Coal	Westphalian.	Yorkshire.	Saar (Heinitz).
Ash in coal, per cent.	12·06	4·18	4·61
Carbon in ash-free coal, per cent. . .	80·62	79·45	82·10
Hydrogen, in ash-free coal, per cent. .	4·87	5·30	5·39
Cold pyridine extract, per cent. . . .	6·50	9·40	5·82
Carbon in pyridine extract, per cent.	81·40	79·75	79·14
Hydrogen in pyridine extract, per cent.	5·96	6·06	6·29
Temperature of ignition in stream of oxygen of—			
20 grammes of the coal.	152° C.	138° C.	165°–182° C.
20 grammes of the residue from pyridine extraction	187° C.	173° C.	172° C.
6 to 9 grammes of pyridine extract .	138°–151° C.	146° C.	—
Bromine absorption of 5 grammes of—			
The coal, grammes	0·7	0·6	1·0
The residue from pyridine extraction, grammes	1·9	0·3	2·6
The pyridine extract, grammes . .	0·0	0 0	0 0

DETERMINING THE EFFICIENCY OF GAS WATER-HEATERS.

Replying to a question addressed to members of the National Commercial Gas Association of America—asked to give formulæ and advice regarding methods of determining the efficiency of gas water-heaters of all types—Mr. H. M. Riley, of the Baltimore Consolidated Gas, Electric Light, and Power Company, replied that the following method may be pursued.

After the proper combustion on the water-heater has been obtained, water is passed through the heater from bottom to top at such a constant rate as to give 60° Fahr. rise in temperature, as shown by the thermometer placed at the top outlet of the heater. This rise in temperature is based on the inlet temperature of the water, as shown by the thermometer placed near the inlet water connection to the heater. At a certain set time, the water is deflected into a tank mounted on scales, and simultaneously the following readings are taken:

1. Inlet temperature of water.
2. Outlet temperature of water.
3. Reading of gas-meter.
4. Water tare.

After passing 100 lbs. of water, the gas-meter reading is again noted, and the weight of water taken and its rise in temperature, as well as the amount of gas burned together with its calorific value—whence the efficiency of the water-heater may be calculated. Of course, during the passing of the 100 lbs. of water, the readings noted above are taken every half-minute. In addition, a barometer reading and temperature of the gas as it passes through the meter are noted at the beginning and end of the test, and correction is made for gas consumption under standard conditions. In this case, the efficiency may be formulated as below:

$$\text{Efficiency} = \frac{W \times (t_0 - t_1) \times 100}{M \times C}$$

Where W = Weight of water passed in pounds.
t_0 = Average outlet temperature of water from heater.
t_1 = Average inlet temperature of water to heater.
M = Cubic feet of gas burned, corrected to 60° Fahr. and 30 inches barometer.
C = B.Th.U. per cubic foot of gas burned.

All temperatures are in degrees Fahrenheit.

Still another test could be run on a gas water-heater, which might be properly styled a "circulating efficiency test." In this case the heater to be tested is connected up to a 24-gallon galvanized boiler—an installation approaching as nearly as possible the conditions of the average household. At least one thermometer is located in the boiler at a point very close to the bottom. The test proper consists in noting the average temperature of the water in the boiler, and then starting the gas-burner in the heater—being careful to note the meter reading at the start. The gas is allowed to burn until the water in the boiler at the thermometer near the bottom shows a temperature of 90° Fahr At this stage the gas is immediately turned off, and the water is run from the boiler as rapidly as possible into a tank mounted on scales. At the point of outlet of the water from the boiler, a thermometer is placed; and readings of temperature are taken every half-minute. In this way, the average temperature of the water in the boiler is obtained; and from the weight of the water as run into the tank, the amount of gas consumed, together with the other data found, the efficiency may be calculated.

LORD WELBY OF ALLINGTON, P.C., G.C.B., who died las Friday, in his 84th year, was elected Chairman of the London County Council in 1899, and was also for many years Chairman of the Finance Committee. The funeral is to take place nex Thursday in Allington Churchyard, Grantham. A memoria service will be held at St. Margaret's, Westminster, the same day.

TAR DEHYDRATION.

By E. V. CHAMBERS, of Huddersfield.

[A Paper read before the Manchester District Institution of Gas Engineers, Oct. 30.]

For all practical purposes, it may be stated that coal tar was ot made in any appreciable quantity until the manufacture of al gas became of importance as an industrial process. The rst private gas-works were erected in 1798 at the works of essrs. Boulton and Watt, since which time the production of al tar has increased enormously.

The tar produced at gas-works in earlier times was looked upon a waste product. Its utility was limited to the manufacture of ofing felt, and as a cheap paint for wood and metals. Some tempts were made to burn tar under retorts; but, for various asons, this practice did not become general. Inquiring minds ntinued to grapple with the potentialities of gas tar; and, as outcome, it was found that by a partial distillation process e tar could be broken up into crude naphtha, creosote oil, and itch. The crude naphtha was used as an illuminant in flare-mps, and the creosote as a preservative for timber—particularly ilway sleepers.

Mansfield, in a patent specification, described the composition the distillates from coal tar together with a description of the rocess for manufacturing pure benzene on a large scale.

Following the production of benzene came aniline oil; and, mediately afterwards (in 1856), Perkin made his great dis-overy—namely, the production of a beautiful mauve colour. the meantime other products had been identified and sepa-ated from coal tar—namely, naphthalene, carbolic and cresylic cids, and anthracene. The latter became of some importance, nd of enhanced value, because of the discovery of artificial lizarin, from which it is manufactured. Contemporaneously ith these discoveries, coal tar distillation was more extensively ractised; and more attention was paid to the fractional separation nd rectification of the products of distillation.

Up to this stage England could take full credit for the develop-ent of the uses of coal tar. Faraday discovered benzene; hile Mansfield carried out industrially Faraday's discovery, and erkin introduced the first artificial dye.

We have been told that "there is a tide in the affairs of men, hich taken at the flood leads on to fortune." This tide was aken at the flood by Continental industrial concerns, and not y the British pioneers. That it led to fortune has been amply roved by the balance-sheets of the various Continental works. arrowing down our observations to present-day conditions, we nd a somewhat chastened attitude of mind towards coal tar. here have been identified more than two hundred distinct com-ounds in tar; and therefore even its very complexity commands espect. Experiences during the last twelve months have also onvinced many as to the actual value of coal tar; and forces are t work which will modify the whole aspect with regard to the tility of coal tar. One very influential factor is the enormous evelopment in road traffic. Modern conditions demand a road urface which will resist the hard wear to which roads are now ubjected. From a hygienic standpoint, we want dustless roads. oads which will be thoroughly cleansed by a good rain shower ithout leaving in its wake a veritable quagmire such as that to hich in many instances we have been subjected.

From the standpoint of available supply, low cost, and high fficiency, there is no product more suitable for these require-ents than partially distilled coal gas tar. By a wonderful com-ination of circumstances, the products of crude gas tar which ender it unsuitable for application to the roads in the raw state, re exactly those products which are in urgent demand at the resent time, and which will continue to be required in an even reater degree after the conclusion of the war. These products re ammoniacal liquor, benzol, toluol, solvent naphtha, carbolic cid, and cresylic acid.

In recent years crude tar has been sprayed on the roads in normous quantities. Many thousands of tons per annum have een thus disposed of; and the loss to the gas companies by thus asting the more volatile products of tar has been enormous, he whole of which amount could have been recovered by a sim-lified process of tar distillation. On the one hand, we have been cattering on the roads a most valuable motor spirit; while, on he other hand, we have been paying high prices for imported etrol.

It has been previously stated that forces are now at work which will undoubtedly have a permanent effect in preventing waste of valuable tar products which have previously gone unchecked. Throughout the whole of the gas profession there has developed a quickened interest in the possibilities of coal gas tar; and for a number of reasons this interest has centred on the dehydration of tar, or, to use a better term, the partial distillation of tar.

Naturally when considering matters of this kind, each gas engineer looks at the proposition from the standpoint of his own gas-works. A question often asked is, "Where and how can the prepared tar and distillates be sold?" The answer to this question depends again upon local conditions and the local authorities. Where the latter use considerable quantities of prepared tar for road purposes, the solution of the difficulty is a comparatively simple one. In such circumstances the prepared tar can be sold with little trouble, and the light oils can be sent away for further purification. But there are many cases where the local authorities are not sufficiently enlightened as to the real value of tarred roads; and unless there is positive assurance of an outlet in other directions, the installation of a dehydrating plant, or rather the disposal of the products arising therefrom, would create a source of trouble.

In such circumstances it is, however, possible that by mutual arrangement the local authorities could be persuaded as to the undoubted advantages of tar macadam or tar-sprayed roads; and it has previously happened that, as a result of a conference, a satisfactory outlet for prepared tar has been obtained.

It should not be forgotten that, as a consequence of the valuable work done by the Roads Board Department, the demand for prepared tar is increasing rapidly; and large quantities are already being used for the manufacture of tar macadam, for tar spraying and pitch grouting. A useful booklet has been compiled by the Roads Board Authorities, entitled "General Directions and Specifications Relating to the Tar Treatment of Roads."*

Broadly speaking, the object of tar dehydration or partial distillation is to prepare a tar, preferably conformable with the standard specifications of the Roads Board Authorities, and, secondly, to prevent waste when previously raw tar has been sprayed on to the roads. Various methods of tar dehydration have been attempted, some of which will now be described.

(1) CENTRIFUGAL PROCESS.

The principle underlying this process was based upon the fact that there is a difference between the specific gravity of tar and water or ammoniacal liquor. Tar remaining at rest in a tank will separate from water by force of gravitation. The tar, being heavier, sinks to the bottom of the containing vessel; while the water rises to the surface. The ordinary gravitation process is somewhat slow; and it was proposed to accentuate the forces of gravity by means of a cylinder rotated at a high speed on a vertical axis—much the same type of apparatus as the centrifugal machine used for drying sulphate of ammonia crystals. The rotating basket of the machine did not, however, contain any perforations. Tar was allowed to flow continuously into the machine. The tar being the heavier body, settled against the wall of the basket; while the water clung to the inner face of the tar. The water was removed by means of a skimming arrangement; while the dehydrated tar passed over a lip at the top of the basket—being collected as it passed between the drum and the outer casing of the machine. By this means, dehydrated tar could be obtained containing no more than 1 per cent. of water.

The centrifugal process did not remove the light oils containing the tar acids; and as it is essential that these should be removed in order to fully meet the requirements for road purposes, the process was not adopted. Incidentally, it may be added that the centrifugal method was fairly successful in removing free carbon from coal tar.

(2) INTERMITTENT PROCESS.

Much of the prepared tar now procurable is obtained by the intermittent process. An ordinary tar-still, holding from 10 to 20 tons is charged with tar. Frequently, the tar has received a preliminary treatment with steam for the removal of surplus water. The distillation process is then carried to such a point that the whole of the water, and a portion of the volatile oils, have been removed. The degree of distillation depends upon the quality of the prepared tar which it is desired to produce.

Certain difficulties present themselves in this method of dehydration. The main difficulty is in the commencement of the process, when the boiling tar develops a tendency to froth or "prime," with the result that the tar escapes from the still by the still-head into the condensing system.

Considerable skill and experience are necessary for the successful working of the tar-still for the production of prepared tar; but, otherwise, it is capable of producing satisfactory results.

(3) THE CONTINUOUS PROCESS OF TAR DEHYDRATION.

Certainly the most successful results in tar dehydration have been obtained by the continuous plant—particularly in installations that are located at gas-works. In the British Isles upwards of 120 continuous dehydrating plants are at work, or in course of construction; while probably the number of intermittent plants at gas-works can be counted on one hand.

The general advantages of the continuous process are:

(1) Continuity of operation.
(2) Low fuel consumption per ton of tar treated.
(3) Reduced wear and tear of plant.
(4) Small area occupied by plant.
(5) Low supervision charges.
(6) Low cost.

Before going fully into the working of a continuous plant, it may be advisable to refer briefly to the light oils produced in the dehydration process. At the present time, these oils are of special interest; while even in normal periods they are of very considerable importance.

Reference has been previously made to the fact that light oils consist of a mixture of benzol, toluol, naphtha, carbolic and cresylic acids, together with a little naphthalene and creosote oil.

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* Published by Waterlow and Sons, Limited, London Wall, E.C.

The quantities got from a ton of average tar vary according to the temperature at which the distillation has been carried out.

As is already well known, the Roads Board authorities have issued three specifications. These are:

(1) Prepared tar for tar spraying.
(2) Prepared tar for tar macadam.
(3) Tar for pitch grouting.

The working temperatures necessary to comply with these specifications on the continuous plant to be described are:

For tar spraying	450° Fahr.	or 230° C.
,, tar macadam	500°	or 260°
,, pitch grouting.	550°	or 288°

It will be understood, therefore, that when working at a temperature of 230° C. for the No. 1 specification, the distillates will contain a higher proportion of lower boiling-point oils than is the case when distillation is carried out at one of the higher temperatures named. The quantities of the distillates also vary according to the temperature at which they are produced, as shown in the following table, which (in addition) gives the quantity per ton of tar distilled, of tar acids—carbolic and cresylic—crude benzol, and crude toluol.

Roads Board Specification.	Working Temperature.	Quantity Distilled. Gallons.	Gallons of Crude Tar Acids per Ton.	90 per Cent. Benzol per Ton of Tar.	90 per Cent. Toluol per Ton of Tar.
No. 1 . .	230° C.	25	4	3	2
No. 2 . .	260° C.	29	5	3	2
No. 3 . .	288° C.	34	5	3	2

The figures vary slightly according to the quality of the tar.

Quite apart from the Roads Board specification, at the present time it is exceedingly important that the whole of the benzol, toluol, and phenol should be removed from crude tar; and for this requirement the working temperature in a tar dehydrating plant should not be less than 260° C. or 500° Fahr., with the thermometer in the tar.

Needless to state, a dehydrating plant (such as is hereafter described) will in a most satisfactory manner remove the toluol and benzol taken up in the gas-washing process; and already a considerable number of such plants are at work for the purpose of removing the whole of the benzol, toluol, and phenol from crude tar which has been used for gas washing.

When one thinks of the enormous volume of tar which is being held-up in the tar-wells at gas-works, one is driven to the conclusion that, in order to relieve the congestion at the distilleries, it would be greatly to the national interest if the raw tar were first dehydrated at the gas-works—thus rendering available at once those products which are so urgently required, while the dehydrated tar could be dealt with at the distilleries in the usual way. There may, of course, be some difficulties in the way of such a procedure, but none which is insurmountable; and after all, national interests should have first consideration.

Naturally, where the tar has been used for gas-washing, there will be a larger proportion of benzol and toluol in the resulting distillates—depending, of course, upon the quantities taken up in the washing process.

A man of ordinary intelligence can, without difficulty, superintend the working of the dehydrating plant, and also the simple type of apparatus necessary for the rectification and fractionation of the light oils. In various parts of the country, this matter is having the serious consideration of gas engineers, and such a proposal has certainly become more attractive, chiefly on account of the fact that considerable advances have been made in the design of rectification plant, particularly from the standpoint of simplicity in the working processes.

The disposal of the light oils is worthy of a little consideration. In most cases the light oils produced are sent away in barrels or tank waggons for further refinement. Where a satisfactory price can be obtained for the oils, and particularly where they are produced in small quantities, this may be regarded as a suitable arrangement. When, however, the quantity of tar dehydrated approaches 10 tons per day, there is no question that the installation of a small rectification plant, if worked in conjunction with the dehydrator, is a profitable undertaking. The demand for the rectified products at the present time is much greater than the supply; and there is abundant evidence that after the war this demand will be continued.

Ten tons of crude tar dehydrated will produce 300 gallons of light oils. By using a simplified type of rectification plant 300 gallons of light oils will produce:

25	gallons of	crude carbolic acid
25	,,	cresylic acid
30	,,	90 per cent. benzol
20	,,	90 per cent. toluol
40	,,	solvent naphtha
150	,,	light creosote oil

Bearing upon the question of the disposal of the light oils, it is worthy of note that in various parts of the country, gas engineers have under consideration the erection of a central works on co-operation lines, whereby the light oils produced at several works will be forwarded to a central rectification plant, there to be rectified and converted into pure products for more immediate requirements. It is proposed to have a complete commercial organization with management, sales, and technical departments. While such a central works will be of very great service during the present national crisis, the fact is not being forgotten that with a return to normal times there will be a very great demand for coal tar products. A central works would be able to place on the market considerable quantities of motor spirit; and it is being suggested that, as the works progress, attention will be given to the manufacture of intermediate products for the aniline colour and allied industries.

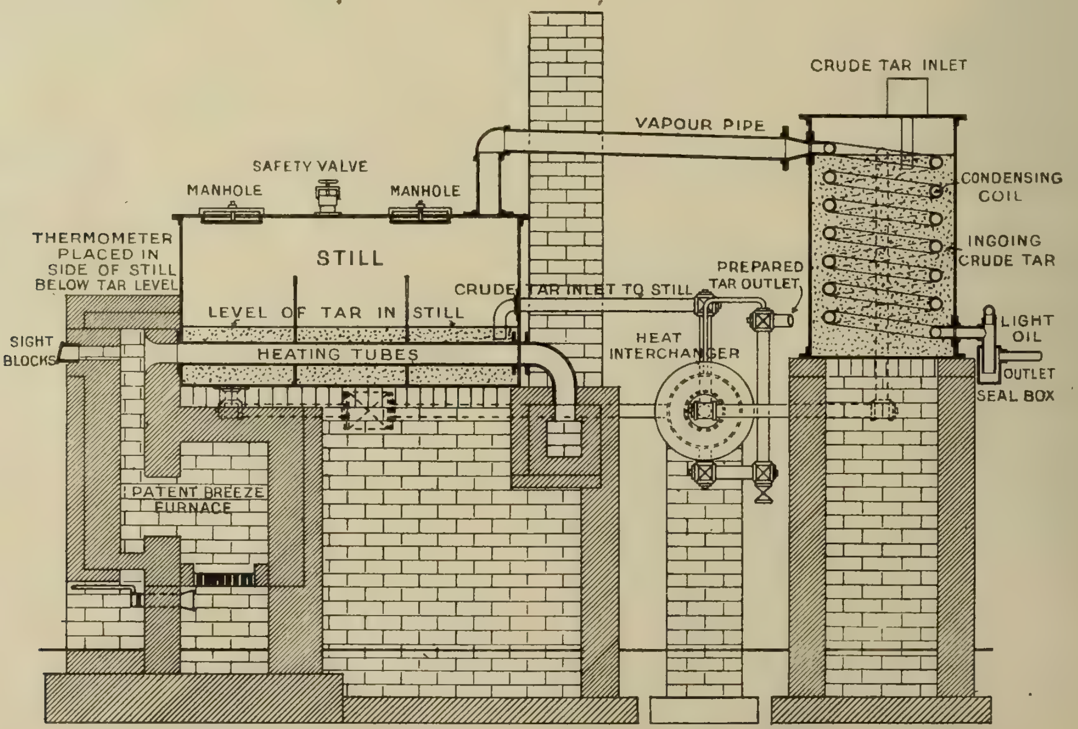
Within a very short time, there is good reason to hope that these proposals will materialize, as it is only by such methods that Great Britain will become less dependent upon outside sources for supplies of those materials which are absolutely essential for the security and continuity of her great industrial undertakings.

Hird, Chambers, and Hammond's Dehydration Plant.

The accompanying illustration shows this particular type of dehydrating plant, which will now be described.

One of the greatest difficulties in tar distillation processes is that of the removal of the water from the tar. In the ordinary type of distillation plant, great care has to be exercised in the earlier stages of tar distillation. Once the water has been removed, the completion of the distillation process is a matter of little difficulty. With the above type of apparatus, therefore, tar dehydration is a difficult process requiring skilled attention.

While water, and possibly free carbon, are at the bottom of the



HIRD, CHAMBERS, AND HAMMOND'S PATENT CONTINUOUS DEHYDRATION PLANT.

ouble in the intermittent pot-still method, nevertheless priming
: frothing and bumping would not occur except for the fact that
the still there is a depth of tar often exceeding 8 feet, while the
aximum vapour space from the surface of the tar to the still-head
ill be 3 feet. When "bumping" takes place at the bottom of
e still, the body of tar becomes honeycombed with the liberated
ises, causing the tar to swell considerably in volume. The
pour space is not of sufficient capacity to contain the expanded
r, which perforce must pass out of the still and forward to the
ndensing apparatus.

In a long series of experiments which we carried out on a work-
g scale it was clearly demonstrated that, in order to entirely avoid
imping and frothing or priming, it was absolutely necessary to
ve such an arrangement of apparatus wherein the tar would not
ve a greater depth than 6 inches over the heating surfaces, and
ierein the vapour space above the tar should be at least five times
at of the depth of the tar over the heating surfaces.

In the continuous plant now under consideration the depth of
e tar over the heating tubes does not exceed 6 inches; while
e vapour space between the surface of the tar and the top cover
the still is not less than 2 ft. 6 in. With this arrangement it
s been proved that, in plants having a capacity of 20 tons of
: distilled per 24 hours, even water gas tar containing 40 per
nt. of water can be dehydrated without any trouble. It is
actically impossible to distil water gas tar in a pot-still. But
adopting the principle of film evaporation and ample vapour
ace the difficulties of tar dehydration are overcome.

METHOD OF HEATING THE STILL.

The wrong method of heating tar distillation plants has caused
ich trouble. In the underheating methods as applied in the
linary pot-still process, even when the utmost care is bestowed
on the heat regulation, it often occurs that the tar in the still
comes carbonized and adheres very firmly to the still bottom.
ie transmission of heat from the fire to the tar is, therefore,
arded, while the bottom plate becomes overheated, and rapid
preciation of the still bottom takes place—necessitating fre-
ent stoppage of the plant for renewals and repairs.

In the illustration it will be observed that the heat from the
ke-breeze furnace passes through horizontal tubes fixed near
the bottom of the still. This method of applying the heat to
tar has several distinct advantages. The heat is evenly dis-
buted throughout the mass of the tar. There is promoted a
pid circulation of tar around the heating tubes—thus pre-
nting the deposition of free carbon on the heating surface, and
suring a rapid transmission of heat through the tubes. The
oes are generally expanded into the end plates, with the original
a that, if for any reason they became defective, they could be
sily removed and replaced.

As time passes, it becomes more evident that such renewals will
t be of frequent necessity. The first plant installed commenced
rking about 2½ years ago, and to-day the tubes are in first-
ss condition. As the whole of the depreciation in working is
nfined to the heating tubes, it may be taken for granted that
preciation is of little importance in this method of working.

FUEL.

Either gas or coke breeze may be utilized for heating purposes.
any of these plants are heated by means of a Goodrich and
amlyn coke-breeze furnace, with which excellent results are
tained. When gas is used for heating, suitable bunsen burners
supplied; and each tube is fitted with an independent adjust-
le burner. Coke breeze is, of course, a cheaper fuel than coal
s. The latter, however, requires less attention, and is therefore
eferable for small plants having a maximum capacity of 5 tons
tar per 24 hours, while for larger plants coke breeze is to be
commended.

In comparing the costs, much depends on the value set upon
al gas. In actual practice, it has been found that a ton of tar
n be distilled to conform to the No. 2 Roads Board specifica-
n (working temperature 260° C., 500° Fahr.) on a consumption
67 lbs. of coke breeze. With gas heating, a ton of tar distilled
der identical conditions will require 550 cubic feet of coal gas
500 B.Th.U. power.

HEAT ECONOMY.

The prepared tar on leaving the plant has a temperature of
m 230° to 260° C.; and naturally, therefore, means have been
opted for conserving this heat. The raw tar, before entering
plant, flows through a horizontal heat interchanger, and
ereby the ingoing tar is heated to a minimum temperature of
° C.; while at the same time the outgoing prepared tar is
oled to such a temperature that it can be discharged either
ectly into casks or into receiving tanks.

CONDENSING LIGHT OIL VAPOURS.

The water and light oils driven off in the distillation process are
ndensed by the ingoing tar. As the light oils represent only
per cent. of the total weight of tar entering the still, condensa-
n is complete; while the temperature of the condensed light
is sufficiently high to prevent the crystallization of naphtha-
e in the condensing coil and in the seal-box.

SIGHT SEAL-BOX.

It is compulsory in all tar distillation processes to make ar-
ngements for conveying the uncondensed gases from the plant
some form of purifying apparatus. These gases consist chiefly
of sulphuretted hydrogen, with some ammonium sulphide. A small oxide purifier fully meets all requirements. The seal at the plant is carried to a depth of 3 inches; and the fouler vapours are conveyed directly to a small purifier—generally about 4 feet square by 2 feet deep, with one grid—containing oxide of iron to a depth of 1 foot over the grid.

WORKING OF THE PLANT.

Having described in a sectional manner the working process, it only remains to follow the course of the tar through the dehydrating plant. The crude tar, fed by an overhead tank or direct from a pump, enters the heater, which is fitted internally with a cast-iron condensing coil. The cold tar condenses the light oil vapours in the heater, and is itself warmed by the hot vapours. Leaving the heater, the tar passes forward to the heat interchanger, where it takes up heat from the outgoing prepared or dehydrated tar. From the heat interchanger, the tar enters the still, which is a rectangular tank with a flat bottom and fitted with baffle-plates, so that the course of the tar is controlled. It flows from the cooler end of the still by a circuitous route, until it finally reaches the hottest part of the heating tubes, by which time the dehydration process is complete. The hot tar then leaves the still, and passes through the heat interchanger into the receiving vessel. The light oil and water vapours driven off are condensed, as already stated, in the heater.

The process can go on continuously night and day for fairly long periods. Plants are at work which make continuous runs of nine and ten weeks, when it becomes advisable to stop the plant for general inspection and cleaning.

In order to vary the quality of the prepared tar, it is only necessary to adjust the tar-feed. Once adjusted, it will be evident that any temperature can be uniformly maintained; and this is well borne out in actual working.

The apparatus can be worked in close proximity to dwelling houses without fear of creating a nuisance; and no complaints whatever have been made with regard to this matter.

WORKING CHARGES.

These depend, of course, upon the type of apparatus employed and also upon other smaller factors. Actual results obtained in the type of plant described, having a capacity of 24 tons of tar per 24 hours, are as follows:

Per Ton of Tar.

	d.
Fuel—67 lbs. coke breeze at 10s. per ton	3·6
Labour.	6·0
5 per cent. interest and 10 per cent. depreciation . .	2·6
Rent, rates, and taxes, office, and management . .	1·2
	13·4

Products Obtained.

	£	s.	d.
160 gallons prepared tar at 3d. per gallon (at works)	2	0	0
30 gallons naphtha and light oils at 5d. per gallon (at works)	0	12	6
10 gallons liquor	0	1	0
	£2	13	6
Less working costs	0	1	1½
Net value of products from 1 ton of tar .	£2	12	4½

In the case of another plant of similar capacity, using coal gas instead of coke breeze, the net value of the products of distillation, based on exactly the same figures as the foregoing, was £2 11s. 8d.

It should not be forgotten that the forenamed figures relate only to crude tar which has not been used for gas-washing. Tar which has been used for this purpose will give somewhat better values.

CONCLUSION.

In conclusion, it may be of interest to state that the dehydrating plant forms the first unit of a complete tar distillation plant for the production of naphtha light oils, creosote oil, naphthalene, anthracene oil, and pitch. A considerable number of installations are now in hand, which will ultimately be converted into complete tar distillation plants. Under these conditions, the experience obtained by working the tar dehydration plant will be of considerable value when subsequently a complete tar distillation plant is installed.

From experience gained by close association with many of the gas undertakings throughout the country, there is little doubt that the question of tar disposal is one which is having very serious attention; and there is a strong probability that the future will bring about a considerable development with regard to the working-up of tar by the actual producers.

By working on co-operative lines, and with centralized distillation works, there is a good promise of success. There is a wide field in which to work, and much leeway to make up; but with enterprise and determination the gas undertakings may take a very active part in restoring for this country the fruit of those industries for which Great Britain sowed but which others reaped.

DISCUSSION.

The **PRESIDENT** (Mr. J. G. Newbigging) said they had had a very excellent paper, full of useful information. The value of it was enhanced by the fact that Mr. Chambers had had great practical experience in tar distillation. The paper showed them there was wide scope to extend their operations; and it would increase the number of works dealing with tar. He quite agreed with Mr. Chambers in the idea of working on co-operative lines in the case of the smaller works.

Mr. John Bond (Southport) said he thought it would be necessary for every gas engineer throughout the land to seriously consider the question of fixing some class of tar hydration plant, because it was well known that the War Office order prohibited the use of crude tar for road work. He should like to ask the author of the paper the size of works in which he considered it would pay to instal a plant. He had gone into the question, and it would not be thought profitable to a works carbonizing less than 3000 tons of coal per annum. He had been asked several questions as to whether loans to gas undertakings could be raised in respect of this plant, and had received a letter from the Assistant-Secretary of the Local Government Board in the course of which he said that they would be willing to consider applications from local authorities owning gas undertakings in England and Wales for sanction to borrow money for the provision of plant for dehydrating coal tar. There had been a certain amount of flexibility in the past in regard to the carrying out of the War Office order as to roads; but he had been led to understand that in future the order would have to be carried out to the letter.

Mr. A. E. Mottram (Ossett) alluded to the figures quoted by the author, which he had noted with interest, because he was going to put down a tar dehydration plant. The figures would be difficult for him to work up to; they were "terrific." Whereas he (Mr. Mottram) came out with a profit of something like 10s., Mr. Chambers quoted figures which gave a difference of 30s. Mr. Chambers showed he distilled about 4 gallons of tar for a farthing. He did not think the author could have taken into account the full cost of the plant, including buildings, and the foundations, *plus* the number of barrels they would have to buy when they went into the tar dehydrating business. He considered that a lot more expenses required to be added to Mr. Chambers's balance-sheet. He (Mr. Mottram) had made out a balance-sheet for their works; and he found they made a profit of 15s. above what they got from the tar distillers. Of course, they were getting nothing yet. They were trying to fix a price for what they would be likely to get. [Laughter.] Other makers of plant, he noticed, claimed that they distilled at the rate of a farthing a gallon. The author's figures were therefore four times better than others. He would like Mr. Chambers to give them further information as to whether it would not be better to have a constant flow through a feed tank than to depend upon the intermittent pump. They had no difficulty at Ossett in disposing of the prepared tar.

Mr. J. H. Brearley (Longwood) asked whether the remarks made by Mr. Bond with reference to the War Office "making something compulsory" referred to putting down tar distillation plants, or whether it referred to toluene. The difficulty he saw was that of disposing of the prepared tar. In Lancashire and Yorkshire, gas undertakings in some cases crowded round one another; and it would be impossible to dispose of all the tar in their own neighbourhoods. Then they would be thrown back on the question of going on someone else's district. He suggested the Institution should centralize the question; something should be done at any rate to improve the present prices of tar. No doubt cases were continually occurring where gas undertakings were not being treated as fairly as they ought to be. If by a joint conference they could evolve some solution of their difficulties, it would be of advantage to themselves and others.

Mr. Bond said the allusion he made was to the War Office order that no crude tar be used for road-making purposes.

Mr. H. Kendrick (Stretford) remarked that if Mr. Chambers's figures were correct they ought to be tumbling over each other to adopt the process. He happened to be one of those who were getting the best prices for tar under the sliding-scale of contracts. If, however, he adopted the process, he ought to be getting 22s. per ton more than he was at the present time, if he could sell it all as prepared tar. If there was such a huge profit out of it, why were tar distillers not selling it as prepared tar, when they were compelled to take so low a price as 19s. per ton for pitch? In towns and urban districts like those supplied by Stretford, he must still stick to his old method of distilling crude tar.

Mr. J. Wilkinson (Nottingham) said he was glad to take this opportunity of correcting a wrong impression which prevailed as to the enormous profits made by tar distillers. He thought every undertaking should be compelled to tar-wash, in order that the light products should not be lost. He thought that Mr. Chambers would have to alter his figures showing the results obtained. The process, no doubt, was a valuable one; but their friend would have to change his estimates with regard to working costs—especially depreciation and wear and tear of plant. He confessed that he should have been much more satisfied had the author been able to give them the strength of the acids. Turning again to the balance-sheet, it would be a mistake if the members took the figures seriously to heart. Mr. Chambers had said in the course of his paper that some of the newspapers and magazines had taken to "romancing" when dealing with the question of tar products. He (the speaker) was afraid that perhaps their friend had been similarly smitten when he prepared these figures. At least 33⅓ per cent. should be taken off the author's figures.

Mr. R. H. Clayton (Manchester) was invited to contribute to the discussion; but very little could be heard of his remarks—except by those in his immediate vicinity, and possibly by the author of the paper—beyond his opening statement that he had to be very careful not to give anything away. He was, however, understood to say that he felt like a lion among the wolves; but he did not intend to criticize Mr. Chambers's figures, because it was not his place to do so. He was a tar distiller; and he had nothing whatever to say about Mr. Chambers's plant or what he had advocated on its behalf. With regard to the remarks of the last speaker referring to centralization, he thought that smaller works would not be able to give the installations the attention which was so necessary to make the project successful. This was a point which might be overlooked. He thought the modern gas engineer had plenty of work on his hands at the present time, without taking on more business of this sort. Alluding to statements which were made as to the high profits of tar distillers, money they were making was invested in further experimental work in carrying forward the business they had to conduct, or perchance the industry would stop. The money they had spent in experimental work alone amounted to a very considerable sum indeed.

Mr. J. P. Leather (Burnley) said at the present moment, if he were asked to advise his Committee on the question discussed that afternoon, he would not go in for a dehydrating plant. He should want to look further. There were obvious advantages in the scheme put forward by Mr. Chambers; and the matter would well repay going carefully into.

Mr. S. Tagg (Preston) asked the author whether he could form any estimate as to the quantity of prepared tar now being used by various county councils and borough councils.

Mr. George Helps (Nuneaton) said the author referred to breeze as a cheaper fuel than coal gas. What price did he reckon the gas at? He knew the President was able to make gas at 4d. per 1000 cubic feet. [Laughter.]

Mr. George Stevenson (Long Eaton) was invited by the President to say something about the co-operative system which was at present working in the Midlands; but his contribution was chiefly confined to toluene.

Mr. Chambers, in replying to the discussion, said that he quite agreed with Mr. Bond as to the minimum quantity of tar which could be dealt with in a remunerative manner. As a matter of fact, a plant of one ton per day capacity made a favourable return. With reference to Mr. Mottram's observations, he (Mr. Chambers) was somewhat in a dilemma. He knew something of the proposals which Mr. Mottram was making to his Council. He had no doubt, however, that if Mr. Mottram did not realize the figures given in the paper, not only would Mr. Mottram get into trouble, but there might be trouble for the makers of the plant. He did, however, strongly assure Mr. Mottram that the results given in the paper were taken from practical working results. As to Mr. Brearley's remarks, Mr. Bond had already said that it was extremely unlikely that any more raw tar would be allowed on the roads in future; and this in itself would tend to increase the demand for prepared tar. There would also be more tarred roads in future, but in any case a central complete distillation scheme would fully meet the difficulty as to the disposal of tar. Mr. Kendrick was assured that already in tar dehydrating plants at work a profit of 22s. per ton was obtained. He (Mr. Chambers) was glad that Mr. Wilkinson had raised the question of complete tar distillation, as this gave him an opportunity of stating that already there were a number of complete distillation plants at work, consisting, in fact, of three dehydrating plants working in series. The distillation could be carried to any length required; pitch with a twisting-point of 86° C. being obtained in one of the plants. The continuous plant was quite simple to work. The tar acids obtained did not consist altogether of 60 per cent. crystallizable carbolic acid, and it was not intended (in the paper) to convey such an impression. When Mr. Wilkinson said that prepared tar was being sold at 2d. per gallon, he could only remark that, if the price had fallen so low, the blame rested entirely with the gas managers. They controlled the raw material; and it was therefore entirely their own fault if they did not realize fair prices. He quite agreed with Mr. Clayton that centralized distillation works only could deal satisfactorily with coal tar. If Mr. Clayton would refer to the paper, he would see the idea strongly suggested. The ownership of such works depended entirely on the will of the gas undertakings. He agreed with the observations of Mr. Leather, and said that there was to-day ample evidence that Mr. Leather's ideas would shortly materialize.

DETERMINATION OF BENZOL IN GAS.

The "Journal für Gasbeleuchtung" of the 16th ult. contained a communication by Dr. C. Neubeck, of Herne, from the laboratory of the Hibernia Mining Company, on a method of determining benzol in gas, which is a modification of that of St. Claire Déville, but is stated to be more convenient and exact than the latter.

It is pointed out that the method hitherto generally used in laboratories in the Rhenish-Westphalian coal district has been absorption of the benzol in cooled washing oil, and distilling the latter up to 120° C. The reliability of the method has been tested by volatilizing benzol in a current of air, which was then passed through the cooled washing oil, from which the benzol was after-ards distilled off. The results are low—for 24 grammes of benol 22·5 grms. were found; and for 11·95 grms., 10·45 grms. were ound. The oil does not yield up the whole of the benzol disolved in it on distillation to 120° C. The method is, moreover, ather troublesome and tedious.

St. Claire Déville's method of freezing the benzol out of the gas as also been used. But it has been found that the cooling-worm liable to obstruction; the insulation is faulty; and a correction necessary for uncondensed benzol, since the vapour-tension of enzol is not *nil* at the temperature attained. The method has, erefore, been modified in the following manner: A wide mouth provided to the cooling-worm, which is weighed along with a nall attached absorption vessel containing paraffin oil, which intended to retain any benzol vapours which might otherwise scape with the expanding gases when the worm is removed from e freezing vessel. The worm is placed in a Dewar vacuum essel closed by a cork provided with a low-temperature alcohol, ermometer. The vacuum vessel is protected by a felt jacket nd stands in a metal container. The worm is closed by a small lcium chloride tube, which retains water vapour from the air. olid carbonic acid ["snow"] is packed round the worm in the acuum flask, sprayed with ether, and when thus softened pressed own firmly. This packing extends to the cork of the flask. The rk (with thermometer) is inserted, and the temperature, when e apparatus has been thus prepared, is – 78° C. The gas is ssed through two drying towers and an experimental meter into e freezing vessel. One charging serves for about 15 cubic feet gas, which is passed through up to a rate of 1¾ cubic feet per our. At the end of the test, the worm with the paraffin-oil vessel taken out and adhering carbonic acid "snow" removed—care eing taken to avoid "burning" the skin by the cold material. he worm is weighed again when the temperature has become ualized; and the condensed benzol may be examined by distiltion if required. The results obtained from air into which known antities of benzol have been volatilized are exact. An advantage the method is that no refrigerating plant is required, but only cylinder of compressed carbonic acid.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

he Gas Industry and the Government: The Question of Financial Restrictions.

Sir,—The subject of the difficulties which are being experienced all er the country by gas undertakings in need of capital for the extenon of their works or the provision of appliances for their consumers, as brought before the Executive of this Association at their last eeting; and as a result the Explosives Department of the Ministry of unitions was asked, and readily agreed, to receive a deputation on e subject.

The President and the Honorary Secretary of the Institution of Gas ngineers, the Chairman of the Council of the Society of British as Industries, and the Chairman of the Executive and the Secrery of this Association were accordingly received last week by Sir othern Holland on behalf of Lord Moulton; and the following oints were submitted by them for consideration:—

It was pointed out that

(A) *On the one hand*

1. The Government (Munitions Department) are pressing the gas industry to provide as large a supply of toluol as possible for the manufacture of high explosives.
2. The Government (Parliamentary War Savings Committee) are urging the public to use gas and gas coke instead of coal, so as to ensure economy for themselves and toluol for the Government.
3. The Government (War Office and Admiralty) are calling (*a*) for more men; (*b*) for the employment of women in factories, on farms, and upon all classes of industrial instead of domestic work; and (*c*) for the increased output of munitions.
4. To reduce industrial labour, manufacturers are putting down gas furnaces and other apparatus in lieu of coal-fired plant, as the former require far less labour to operate than the latter.
5. To reduce domestic labour, householders are ordering gas cooking and heating stoves and gas-heated hot-water circulators by tens of thousands. For the purchase of these, either capital is required by the gas undertakings if they are lent or hired by them to the public, or must come out of the purse of the public if the stoves are bought by them outright. The financial effect is the same.
6. For the production of munitions with the utmost speed and a minimum of labour, manufacturers are installing gas-engines, furnaces, and other gas-heated apparatus in large numbers.

(B) *On the other hand*

7. The Government (War Office) are not using gas as fully as they might either in buildings taken over temporarily for Army Pay Corps and other purposes or in new premises for which a supply is available.
8. The Government (Treasury and Local Government Board) are refusing financial facilities to gas undertakings for the purchase and supply of gas cooking, heating, and hot-water appliances, or for the carrying out of extensions of manufacturing plant required to supply larger quantities of gas.

(C) *It was therefore submitted that*

9. The various Government Departments having control of buildings (War Office, Admiralty, Office of Works) should be instructed to use gas wherever possible both as a light and a fuel; and that
10. The financial restrictions imposed upon gas undertakings at present should be promptly relaxed.

The various points submitted were fully and sympathetically discusssed by Sir Sothern and the other officials of the department; and it is hoped the influence of the Ministry of Munitions will be used for the amendment of the present illogical position, in which restrictions are being imposed by some Government Departments which are preventing the industry from meeting the wishes and requirements of the Munitions and other Government Departments.

If the managers of any undertakings which are experiencing difficulty in obtaining the money necessary to enable them to supply the country's needs of high explosives, and to keep the public supplied with the coke and gas they are officially advised to use instead of coal, will communicate full particulars to the undersigned, steps will be taken to bring the matter before the Ministry of Munitions, with a request for their assistance.

W. M. Mason, Secretary,
British Commercial Gas Association.

47, *Victoria Street, S.W.*,
Nov. 1, 1915.

◆

Training for the Gas Profession.

Sir,—I have read with interest the admirable Presidential Address, delivered by Mr. David Fulton, before the Scottish Junior Gas Association, and am pleased to observe that the question of the training and examination of young men employed in connection with gas undertakings has received such a fair consideration by the Scottish Juniors.

On the subject of guiding candidates preparing for the City and Guilds Examination, my reports as Examiner were usually directed to giving some guidance both to teachers and students. Particularly was this so in the report on the 1912 examination. It must be obvious that, if candidates were required to pass a preliminary examination in Chemistry and Mechanical Engineering, before sitting for the Gas Engineering examination, many unsuitable candidates would be barred, and much of the Examiner's time saved.

The City and Guilds of London Gas Engineering certificate has had an increasing value and importance; and to safeguard worthy candidates, it is advisable, in my opinion, to insist on preliminary examinations such as I have indicated. In the absence of such provision by the examination authorities, engineers, teachers, and others who are interested in candidates should use their influence to see that the preliminary training is not neglected.

Many candidates have a good knowledge of chemistry and no knowledge of engineering; while a smaller number have a good knowledge of engineering, and a poor knowledge of chemistry.

A successful gas engineer must have a good knowledge of construction, a thorough knowledge of chemical reactions, and the technique of gas and chemical engineering, with sound commercial aptitudes.

I trust these remarks may be of some service to young men aspiring to be gas engineers, and who intend submitting themselves to the City and Guilds of London examination.

Thos. Glover.

Norwich, Oct. 30, 1915.

◆

The Recent Benzol Explosion at Beckton.

Sir,—At the inquest held as a result of the recent fatal fire at the Beckton Gas-Works, no one was able to throw any light on the probable cause of the explosion. I venture to offer the following suggestion as a possible clue to the disaster.

When liquids are discharged through a pipe, it is well known that they acquire an electric charge. It follows that the receiver itself becomes charged, the potential of which may grow dangerously high in favourable circumstances—such as a dry atmosphere, a poor conductor between the earth and the receiver, and sufficient time to allow of the growth of potential. Under these conditions, it is quite possible for the electric charge to be raised to such a high potential as to cause an electric spark.

The evidence given before the Coroner, as reported in the "Journal" for Oct. 26, showed that the benzol was caught in a drum standing on a wooden or concrete floor—a method which certainly favours an accumulated electric charge.

The presence of such a charge can easily be demonstrated by connecting the receiver with a gold-leaf electroscope. The danger is entirely avoided by "earthing" the receiver.

Where the outlet of the benzol still discharges directly into a tank, no danger can possibly arise, as such a tank is often buried underground, or if not, is "earthed" through its pipe-connections.

B.Sc.

Oct. 29, 1915.

[Referring to the explosion to which our correspondent alludes, the Engineering Supplement of "The Times" last Friday said: "The Beckton disturbance was not due to any derangement in the primary portion of the plant, but took place in the subsidiary apparatus where rectification of benzol proceeds. It is extremely difficult to determine the actual cause of such an occurrence; but it seems more than probable that the condensing apparatus may not have been working with its usual efficiency, the result being the escape of inflammable vapours. The probability of such vapours becoming ignited would be accentuated if the plant was confined in a closed building; and ignition might be caused in many ways. Concrete floors are frequently a source of danger, owing to the sparks thrown up when they are struck with any implement, such as a shovel. An electric spark might also account for the trouble."]

REGISTER OF PATENTS.

Low-Temperature Distillation of Coal.

Lamplough, F., of Pall Mall, S.W.

No. 15,892; July 2, 1914.

This invention has for its objects to subject the coal to partial distillation in such a way that the coal does not reach the coking stage, so as to remove only the light oils and hydrocarbons and leave a smokeless fuel. It is well known, the patentee says, that the ordinary methods of retorting coal for the production of gas and coke are not effective for the production of oil or of ammonia from the coal—due partly to the conditions under which the distillation takes place and partly to the fact that as coke forms on the inside of the retort it insulates the coal in such a manner that excessive heat is required to reach the centre of the retort, so that a considerable decomposition of the oil takes place.

Fig.1.

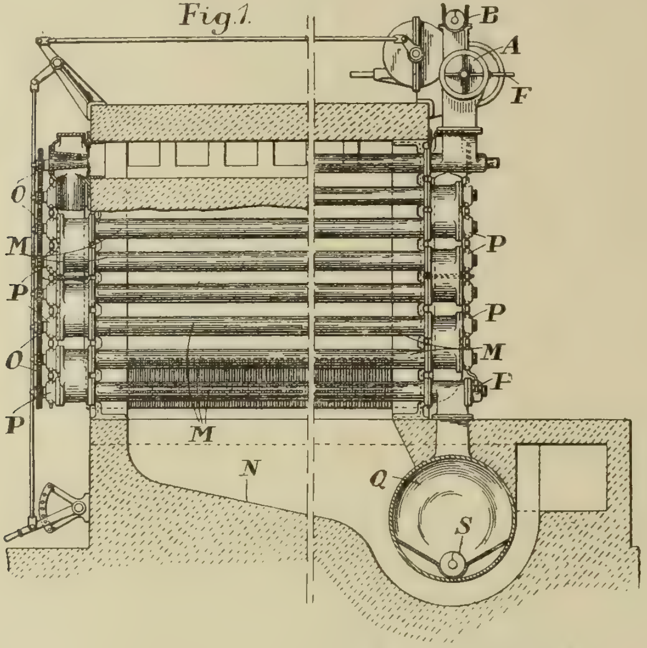


Fig.2.

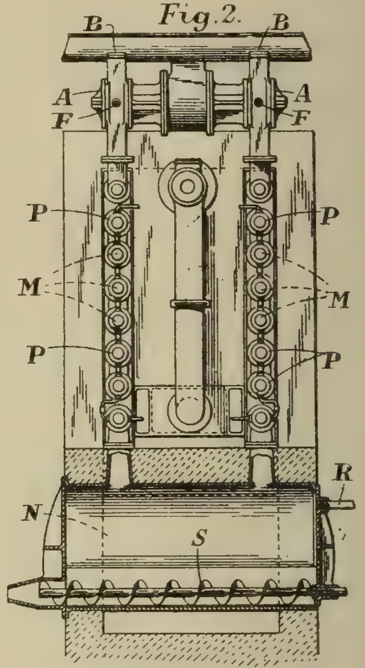
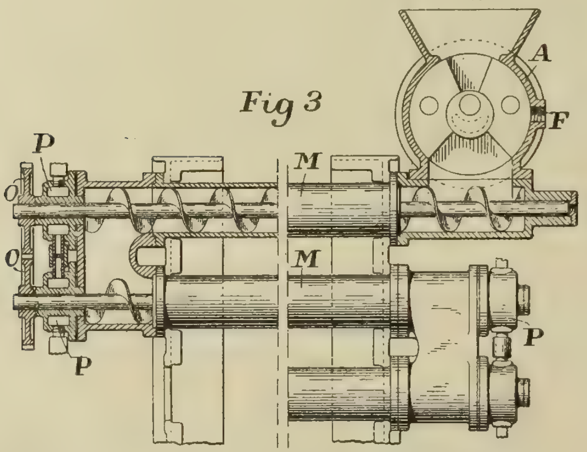


Fig 3



Lamplough's Low-Temperature Coal Distillation Plants.

The inventor proposes to introduce the coal into the retort by a measuring hopper so constructed as to deliver definite measured quantities of coal of any desired amount without permitting the escape of gases on the one hand or the ingress of air on the other. A number of retorts in series, fitted internally with worm conveyors, are employed; and the coal which has been subjected to partial distillation is finally discharged into a receptacle from which the coal, while still hot, can be removed and formed into block fuel.

Fig. 1 is a longitudinal section of the apparatus. Fig. 2 is an end view, showing the discharge receptacle in section. Fig. 3 is a longitudinal section of a portion of the apparatus (on a larger scale).

The coal is brought to the measuring hopper A through a trough B containing a worm conveyor continuously operated. The measuring hopper discharges into an outlet leading to the retort system. It has two central concentric shafts passing through the hopper into the operating gear and carrying two segmental blocks which extend axially the whole width of the hopper, and each of which extends circumferentially about 120°. These blocks are caused to rotate (at varying speeds) in such a way that at one stage the space between the blocks comes below the inlet to the chamber A so as to take in a quantity of coal, and at another stage the coal is discharged and the blocks are so moved as to prevent any gas being carried out into the atmosphere. To prevent air entering with the coal a pipe F is fitted to the hopper casing through which steam at low pressure is passed, sufficient to keep the air out of the hopper neck. The steam also passes through the retort and "is instrumental in carrying the rich hydrocarbons out of the hot zone as fast as they are generated, and it also assists in the production of ammonia."

The ends of the shafts of the blocks enter a casing containing operating gear therefor, and have mounted on them within the casing cranks which move in relation to one another, but in their middle position are something more than 90° apart. They are connected by links to cranks (carried rigidly on an operating-shaft) so attached to the shafts of the blocks that the latter move at unequal speeds during different portions of their rotation. The result is that the blocks are first opened out to take in a charge of coal, then moved to carry it round to the discharge outlet, and on reaching the outlet the space between them from which the coal has been discharged is closed up—a movement which opens out a space on the opposite side of the blocks to take in a fresh charge of coal, which is delivered as has been described with reference to the first charge.

The operating shaft carries a tooth wheel adapted to be operated by a pawl pivoted on the end of a pitman connected by a pair of short links to one double arm of a bell-crank lever, the other arm of which (also a double arm) is connected to the crank-pin on the main driving shaft of the whole apparatus. In this way, the rate of feed through the hopper can be regulated. From the hopper the coal drops into an extension of the uppermost retort M. The retorts are arranged one above the other in the setting N, and they consist of horizontal cylinders each of which is fitted with a rotatable worm conveyor operated by external toothed gearing O. The bearings of the conveyors are water cooled, as shown at P.

The coal is thus gradually conveyed through one retort M and falls out of the end into the next retort, through which it is conveyed in the opposite direction; and so on through as many retorts as is necessary. Then the coal which has been partially distilled is discharged into a receptacle Q, into which are passed the vapours from the retorts, and thence conveyed away to the scrubbers and condensers through an outlet R. The residual coal (which contains a fair percentage of heavy oil and tarry matter) is conveyed by a screw-conveyer S into a suitable press to form it into fuel blocks.

The retort tubes are raised to a temperature of 400° to 600° C., according to the nature of the coal to be treated.

Gas-Washers.

Pope, C. E., of Pittsburg, U.S.A.

No. 19,847; Sept. 16, 1914.

This invention relates to "apparatus with a suspended rotor for cleaning and purifying by washing and beating carbonaceous and other gases, and for extracting impurities and bye-products therefrom."

Heretofore, the patentee points out, gas-cleaning apparatus of this type has been used in which the gas, in passing through it, is subjected to a thorough stirring and agitation in a devious passage-way in the presence of water or other purifying substance introduced through a water-seal round the rotor shaft; and usually the mechanical stirring of the gas has been by means of a rotary beater revolved at high speed by a vertical supporting and driving shaft. The present invention comprises "an improved mounting for supporting and driving the rotor of a gas-washer of the type named, for admitting water to the interior through an improved water-seal, and for allowing self-adjustment of the rotor within narrowly restricted limits in a manner to insure smooth and quiet running."

The patentee illustrates a form of machine embodying the invention and particularly designed for washing and purifying the gases generated in bye-products coke-ovens and extracting the ammonia, tar, and other bye-products from the gas.

The claim made for the invention is for "suspending the rotor of the washer and its driving wheel by a ball-bearing and end-thrust support and journal bearings that are free to adjust themselves about a point approximately at the centre of action of the driving wheel, and having on the rotor a liquid sealed member co-operating with a double walled annular trough depending within the head of the washer casing through the liquid seal of which liquid is supplied to wash the gas."

Gas Water-Heaters.

Stott, V. H., and Schofield, L., of Oldham.

No. 20,277; Sept. 28, 1914.

This invention relates to gas water-heaters in which a float or inverted up is used for automatically regulating the gas supply, and is an daptation of such regulators to urns and the like.

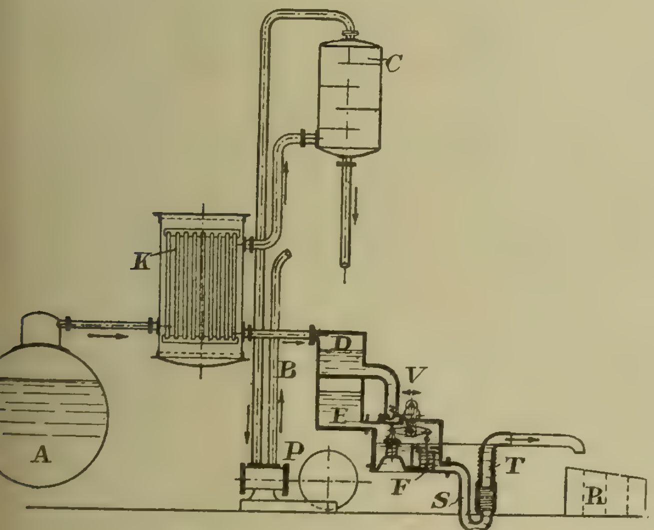
The proposal is to attach an extension piece on the periphery of the d portion of the float or inverted cup positioned in the urn, and to the as-regulating valve is fitted an extended spindle held to its seating by spring, preferably supported upon the spindle, whereby the gas passage partially or wholly closed. The relative positions of the free end of the pindle and the lip or projecting piece are such that, preparatory to the ater boiling, the lip rests upon the spindle; but as the latter is pring-supported, the weight of the float sets up compression at the pring and forces the spindle down, causing the valve to leave its seat- g, and thereby open the gas-way. As soon as the water boils, the oat rises by expansion and relieves the free end of the spindle of its eight, immediately upon which the valve is forced on to its seating y the action of the spring. In this way, by the rising and falling ction of the float, the gas supply to the burners is automatically egulated.

Distilling Derivatives of Tar and the Like under Vacuum.

Neumann, R., of Brünn, Austria.

No. 20,353; Sept. 30, 1914. Convention date, Oct. 1, 1913.

One of the most important requirements in the distillation of tar and e like under vacuum, consists (the patentee mentions) in that, not- ithstanding the vacuum existing in the generating chambers, the dis- llates shall issue freely and visibly into the atmosphere, for the irpose of enabling the progress of the distillation and the quality of e products to be continuously checked. The present invention has r its object to enable the distillate to become visible at much shorter id regular intervals, by admitting the distillate at frequent and regular tervals into a smaller receiving chamber from a condenser and dis- iarging regularly, independent of whether the receiving chamber is iite full or only partly full—means being provided for drawing off on-condensed gases from the condensers.



Neumann's Tar-Distilling Plant.

One form of the apparatus for carrying the invention into effect is ustrated—other arrangements being shown in the specification.

A is the distilling retort; K, the condenser or cooler; C, a barometric ndenser—all operating under vacuum; V, an intercepting apparatus; , the collecting vessel into which the distillates flow in a visible anner; P, the vacuum pump; and B, the exhaust pipe of the vacuum imp for uncondensable (permanent) gases of distillation.

The distillates coming from the cooler K flow into the chamber D er a valve leading into a receiving chamber E has been first closed. mechanical actuating mechanism (lever or the like) the valve is now ened, whereby the distillates are allowed to flow into the receiving amber E, while a valve F remains closed. On the reversal of the lves the distillate flows through the adjustable reversed syphon S T a visible manner into the atmosphere, or into the collecting vessel R. uring this outflow, fresh distillate collects in the chamber D, and the erations begin again. The distillate will thus pass in portions regu- rly into the atmosphere; and in the receiving space E there is vacuum iring one period of working, and atmospheric pressure during the fol- wing period of working.

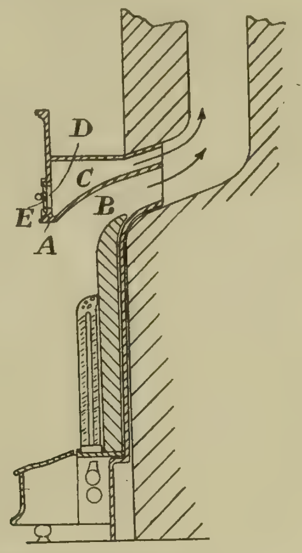
Each time after emptying, the entire space E will become filled with r, which has entered through the reversed syphon; and this air must discharged into the air-pump again during the next operation. For e purpose of making the quantity as small as possible, the chamber E only so large as will enable it to just hold the inflowing amount of stillate. The amount, however, varies considerably in the several iges of the distillation; so that the capacity of the receiving chamber is also variable, by means of the syphon S T. According to the vel of the syphon, the chamber E may be emptied only so far that the e and available capacity situated above a certain level may be ad- sted to the inflowing quantity.

Gas-Fires.

Aird, K., of Falkirk, and M'Geachin, J., of Dumbarton.

No. 3373; March 3, 1915.

This invention relates to gas-fires provided with a passage for the products of combustion with which communicates a passage for air. It has for its object to provide means for regulating the chimney effect on the radiants by the provision of means for controlling the gaseous flow through the foul-air passage.



Aird and M'Geachin's Gas-Fire.

As shown, the fire comprises the usual atmospheric burner and radiants. Over the radiants is the canopy A, below which the gaseous products of combustion flow through the combustion-products passage B. Above the canopy proper is a passage C for foul air—inaccessible to the uprising products of combustion. To regulate the gaseous flow through the passage C the foul-air inlet D is fitted with a valve E of the hit-and-miss type.

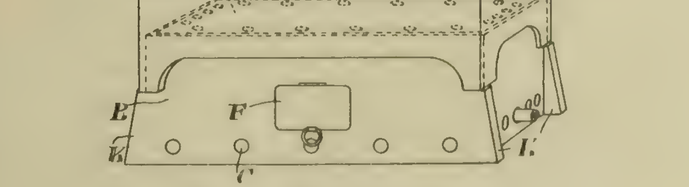
The patentees, in pointing out that while the valve is shown as occupying a position in the fore part of the canopy, its position may be altered to suit circumstances, they claim as their invention: "In a gas-fire of the type referred to the provision of means, substantially such as described, for regulating the gaseous flow through the foul-air passage."

Gas Cooking-Stoves.

Mathews, C. L., of Streatham, S.W.

No. 8255; June 3, 1915.

This invention consists essentially in "the combination with an oven of a closed, separate, and independent burner chamber adapted to be placed under or in the oven and to close it to the passage of any air other than that which passes through the burner chamber."



Mathews' Gas Cooking-Stove.

A perspective view of such a complete burner chamber and a section on the line X are given; also a perspective view showing one method of applying the invention to an oven.

The burner chamber A comprises a closed box B with openings C near the bottom for the inlet of air, and other openings D in the top for the passage of the products of combustion and any heated excess air into the oven. Gas-burners E are arranged in the box, with a door F in the side for lighting them.

In use, the burner chamber would be preferably placed under or inside the oven in such a way that the air inlet openings C are in communication with the atmosphere, while the top of the burner chamber closes the bottom of the oven. Thus all the air admitted to the oven passes through the burner chamber, and, "being highly heated therein, is thoroughly sterilized and purified before it enters the oven."

In the second arrangement shown, the box B is provided with projections K at the corners to support the gas-stove placed upon it. In the other constructions the burner chamber may be made with a double top—one, H, spaced somewhat above the other, J. When this is the case, the inner top is preferably formed all over with a number of comparatively small perforations L for the passage of the gases; while the upper top H has larger perforations D near the edges to lead the hot gases into the oven round the sides. Such a construction is said to "heat the gases more highly and uniformly, and to give a more moderate and even heat on the bottom plate of the oven."

Carbonizing Fuels.

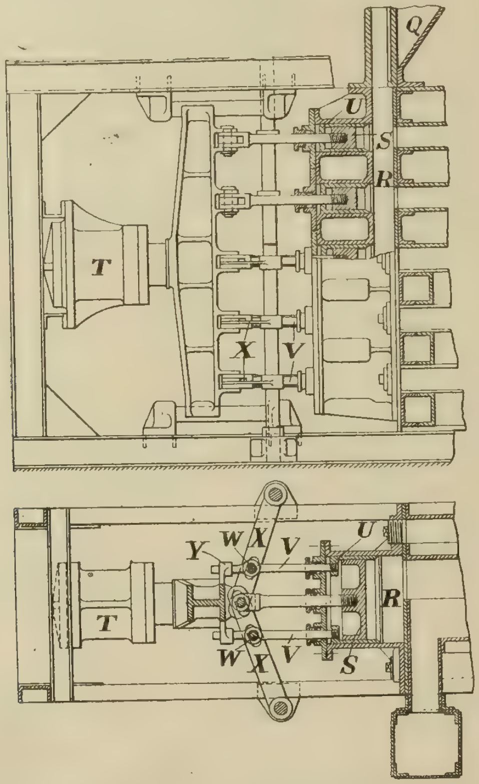
Duckham, A. M'D., of Ashtead, Surrey.

No. 8183; Jan. 5, 1915.

This invention relates to the continuous carbonization of coal at a low temperature in inclined and horizontal retorts; the gaseous products driven off being fractionally collected at successive points in the path of the material as it travels through zones of gradually increasing temperature. The object aimed at is "to enable the distillates at various stages to be collected separately without intermingling and to produce a hard coke."

The patentee proposes to push the material through the retort with such a pressure as to keep it "packed," and thus to enable the gases driven off at the various zones to be collected with the minimum of intermixture. The employment of this pressure, moreover, renders it possible to "produce a hard smokeless fuel which is ready for use without briquetting."

A bench of retorts suitable for the purpose is shown in patent No. 13,934 of 1914 [see *ante*, p. 95]. Finely-divided coal or the like is pushed at frequent intervals into one end of a retort and is thus forced through the retort in a direction the opposite to that in which the heating gases pass around the retort. At suitable distances apart along the retort are openings in the sides so formed that the coal in its more or less carbonized condition does not pass through them. The retort is heated most highly near the end from which the carbonized coal is discharged; while its temperature decreases progressively towards the end into which the coal is fed. The openings correspond with zones of different temperature and lead to separate collectors.



Duckham's Apparatus for the Continuous Carbonization of Coal.

An elevation is given (partly in section) and a plan of an example of means for applying pressure to the charges in a vertically arranged bench of retorts.

The sub-divided coal is supplied from the hopper Q to the shoot R common to all the retorts, and is fed to the latter (the depth of which is preferably between 3 and 6 inches) by plungers S, which receive reciprocating movement from the hydraulic ram T. Between the plunger and its casing slides a sleeve U. As explained in patent No. 13,936 of 1914 [see "Journal," Vol. CXXX., p. 34] the object of this sleeve is to prevent the jamming of the coal in the shoot. The sleeve is connected through rods V, pins W, and slotted links X, with the plunger rod, so that during the forward stroke it moves more slowly than the plunger until at the end of the stroke the plunger has caught up the sleeve. The carbonized coal is discharged from the other end of the retort into a gas-tight shoot, whence it is removed by gas-tight delivery mechanism. The discharge of the material may be hindered if desired so as to increase the pressure in the retorts.

The pressure should, the patentee states, always be sufficient to keep the material so closely packed as practically to prevent the gases from one zone mingling with those from the other zones, and should otherwise be regulated according to the hardness of the coke it is desired to produce.

As in his patent No. 17,502 of 1914 [see "Journal," Vol. CXXX., p. 761] the inventor has claimed the application of mechanical pressure to the charge in a vertical retort, he wishes it to be understood that in this specification he makes no claim in respect of vertical retorts.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following Bills have received the Royal Assent: Clackmannan County Water Order Confirmation, Glasgow Water Order Confirmation (1915), London County Council (General Powers) (1915).

HOUSE OF COMMONS.

Several questions of interest to "Journal" readers which were asked in the House of Commons during last week are reproduced below, together with the answers.

British Dyes, Limited.

Sir J. D. Rees asked the President of the Board of Trade what progress had been made by British Dyes, Limited; and when he expected an actual out-turn of dyes to be effected?

Mr. Runciman: I am informed by the Directors of British Dyes, Limited, that the works acquired from Read Holliday and Sons, Limited, have been considerably extended, and that the volume of dyes produced during the first nine months of this year has been more than double the output in the corresponding period of 1914. A site for new works has also been acquired, and the Company are proceeding with erection there as rapidly as is possible in present industrial conditions.

Statutory Companies' Excess Profits.

Mr. Grant asked the Chancellor of the Exchequer if commercial companies, which existed under statutory limitations in regard to tenure of statutory charges and prices, would be permitted, under the Finance Bill, to submit their cases to the Commissioners for consideration in regard to excess profits?

Mr. Montagu replied that any question of the adequacy of the 6 per cent. rate of return, in view of statutory limitations as to period or conditions of tenure, would be a matter for consideration of the Board of Referees under clause 38.

Coal Prices.

Mr. Perkins asked the President of the Board of Trade whether, having regard to the price of coal in the South of England, which is due to decreased output, he will withhold licences to export coal and coke except to the allies of the United Kingdom during the war?

Mr. Runciman, in the course of his reply, said: The export of coal and gas coke is closely watched by the Coal Exports Committee, and I am not prepared to recommend that licences for export to other than allied countries should be withheld altogether.

Artificial Fertilizers (Supply for Farmers).

Mr. Molteno asked whether the President of the Board of Agriculture had taken any action to secure for farmers an adequate supply of artificial fertilizers for autumn and spring dressings?

Mr. Acland: The President of the Board of Agriculture has appointed a Committee, comprising representatives of his Department, the Scottish Office, the Board of Trade, the Munitions Ministry, and the Admiralty, to make such arrangements as may be necessary and desirable to ensure an adequate supply of fertilizers for the use of farmers. The President has asked me to act as Chairman. With regard to the work of the Committee so far, I am glad to be able to state that the Sulphate of Ammonia Association is co-operating in a most public-spirited manner with the Board of Agriculture in making an arrangement under which sulphate of ammonia in reasonable quantities will be available to farmers for use as an autumn dressing at a very reasonable price, regard being had to its manurial value.

LEGAL INTELLIGENCE.

SEQUEL TO A GAS-STOKERS' STRIKE.

Action for Loss and Damage.

Discussion took place in the Airdrie Sheriff Court on the 22nd ult., regarding the competency of an action raised by the Coatbridge Picture House, Limited, against the Coatbridge Gas Company.

In June last, the stokers in defenders' employment came out on strike for an advance of wages; and a result of the stoppage at the works was that the gas supply of the town was temporarily suspended. The pursuers seek to recover a sum of £50, which they restrict to £20 (to have it determined in the Small Debt Court), for alleged loss and damage, which they say they sustained in consequence of the failure to supply them with gas, whereby they were obliged to discontinue the use of the picture-house, and to refund the price of admission.

Mr. John M'Lachlan, on behalf of the defenders, made the preliminary plea that the action was incompetent. He explained that shortly before the date in question (June 5), the stokers, who were then enjoying what he understood was the largest wage being paid to any stokers in the country, and who shortly before that had been given an extra 6d. per shift, applied to the Company for a further advance of 9d. This was considered as an outrageous demand. The dispute ended in the Company agreeing to give an additional 6d., and to submit to arbitration the question of the other 3d. Notwithstanding this, the stokers struck on the Thursday night, and remained out until the Saturday evening. As a matter of fact, for several hours on June 5 Coatbridge was absolutely without gas. His submission was that an action of this kind, for damages at the instance of a consumer against a public company like this, was incompetent. The Company had a monopoly of the supply of gas in Coatbridge, under an Act which inrporated certain other Acts, including the Gas-Works Clauses Act, 71, section 36 of which was to the effect that whenever the under- kers neglected or refused to give a supply of gas to any occupier of emises entitled to the same within the area of supply, the Company ould be liable in a penalty of 40s. for every day that the default con- ued. The present action was therefore absolutely incompetent. ere was no private contract between the parties here, except in so r as the defenders supplied gas as a public company. If consumers ked for gas, the Company were bound to supply it; but there was private contract. In these circumstances, it would be absurd to hold at any one gas consumer could bring such an action. It would lead ruinous conditions for the Company. The action was the first of e kind brought in this Court; but he believed there were several ses brought in the Courts in England, and disposed of in the way he bmitted this one should be disposed of. He referred to the case of egg, Parkinson, and Co. *v.* Earby and Thornton Gas Company, 1896 . B. 592],* the effect of which was that an action for the recovery of mages by a consumer could not lie against a gas company to which e Gas-Works Clauses Act of 1871 applied—the only remedy such a nsumer had being the recovery of a penalty under section 36 of the t. One of the Judges in that case pointed out that it was very sig- icant that there had been no successful action of this kind, and that company would very speedily be ruined if actions were brought ainst them on such pretexts; while another remarked that as there s no contractual obligation, the appeal must fail. This action was e which could not be entertained, even though there was fault— ich was denied; the Gas Company's contention being that they re in no way responsible for what took place, as it was caused by a ike of stokers over which they had no control.

Mr. J. G. Scott, on behalf of the pursuers, submitted (1) that the fenders here were liable by contract implied; (2) that the non- formance thereof was not excused at common law by the inability one party to perform by their workmen being on strike, unless there s a provision to this effect in their Act of Parliament; and (3) that ere was here a sufficient agreement in respect of the undertaking en by the defenders on the date in question. The defenders under- k, through their Manager, to supply the pursuers with gas. This nt was separate from No. 1, under which Counsel submitted that any npany who became incorporated by Act of Parliament made a con- ct whereby, in return for certain powers and privileges, they sup- ed to any member of the public what they professed to sell. There s, therefore, an implied contract between the promoters and the blic through the Legislature. In this connection, he submitted as elevant authority the decision in *Colquhoun v. Society of Procurators of sgow and the Scottish Widows' Fund*, and several other decisions in High Courts. He then referred to the various Acts under which Company were incorporated, to show that there was nothing in m which negatived the point he was now making; but there was a tion which enabled the Company to enter into, contract, or carry effect any agreement with any town council, police commission, lway company, or any other company or body of persons, for the e of gas or inflammable air for any period not exceeding three years; l that they might vary, suspend, or rescind any such agreement. is, he contended, was the foundation of the contract between the enders and the public. As far as he could see, it enabled them to tract outside the conditions of the Statute; but it did not say that y should not be liable in damage for so doing. He quoted the Gas l Water Orders Confirmation Act, 1909, clause 13, as providing for suspension of the penalty clause against such companies. He ther pointed out, in reference to this clause, that there was no re- ction of it. It did not say there was to be no claim against the de- ders on a breach of contract. There was plenty of authority, refore, for his argument that there was an implied contract between defenders and the public. Any member of the public fulfilling conditions specified by the defenders made a contract. He quoted case of *Milligan and Co. v. Ayr Harbour Trustees*, June 19, 1915 ottish Law Reporter], as being the latest decision on the point that impossibility of fulfilling a contract by the existence of a strike did prevent an award of damages. Dealing with the point that, uming he was wrong as to the implied contract, there was a special eement made with the defenders on this particular date, in respect t pursuers' Manager got an assurance from the defenders' Manager enable him to open the picture-house on the day in question. The ture-house was lit by electricity generated by a gas-engine, and the s Manager (Mr. Thomas Wilson) had assured defenders' Manager t he could re-open his premises. There was, therefore, a special eement; and, consequently, if he failed on the implied contract, he uld succeed on this. He also submitted that the penalty clause did exclude an action for damages at common law.

Ir. M'Lachlan, in reply, said he considered his friend's argument not meet the point that he sought to make for the defenders—that, uming all the pursuers said was true, the action he had taken was ompetent. He had shown nothing in the way of guarantee or lertaking in the sense referred to in the Act by which the Company plied consumers. What he did refer to as a guarantee or un- taking was simply a telephonic communication between the Picture use and the Gas Company as to how they were getting on, and a ly that they hoped the gas would be on in time to let the perform- e proceed. To recognize such an action would be disastrous to com- ies of this kind, because ruinous claims could be made against them.

'he Sheriff took the case to avizandum.

THE LIGHTING OF THE STREETS.

An Action Regarding a Collision with a Refuge.

itting in the King's Bench Division of the High Court of Justice Wednesday, Mr. Justice Avory and Mr. Justice Lush heard an eal from a decision of Judge Parry, in the Lambeth County Court, n action in which George Brown, a taxi-cab proprietor, sought ecover damages from the Lambeth Borough Council for injuries to a cab. The report of the case was given in the "Journal" for May 18 last, p. 413, and June 22, p. 707.

The facts were that on Jan. 6, about 11 p.m., plaintiff was driving a taxi-cab when he came into collision with a refuge in the middle of the road. The plaintiff said this occurred owing to the defendants' negligence in not lighting the refuge. The refuge was generally lighted by an arc lamp, which on this date, under police regulations, had been considerably darkened. At the moment of the accident the plaintiff said that the arc lamp was not alight. He was going at eight miles an hour. The arc lamp was lighted and controlled by an Electric Lighting Company acting for the defendants. The Company's servants found the arc lamp [an automatic one] alight at 5.30 on the afternoon of Jan. 6, and again at 11 o'clock on the morning of Jan. 7. After the accident, a police officer came up and noticed that the light was out; but his evidence was consistent with the contention that the collision itself extinguished the lamp. The Judge said he believed the plaintiff's statement that the light was out at the time of the accident; but there was no evidence at all to show how it came to be extinguished, or how long it had been extinguished, nor was there evidence of negligence on behalf of the servants of the defendants or the Electric Light Company in superintendence, management, or control of the lamp. The general lighting of the place was adequate and reasonable, having regard to the police requirements under the Order in Council for the Defence of the Realm. The fact that the arc lamp was not alight undoubtedly contributed to the accident, as did the speed at which the plaintiff was driving. So, too, did the general darkening of the surrounding lamps, under the Order in Council. The action here was founded on negligence; and there was no evidence of any negligence. Judgment was therefore given for the defendants, with costs.

Against this decision the plaintiff appealed, on the ground that the County Court Judge was wrong in law in holding that there was no evidence of negligence, and that the onus of proving negligence was on the plaintiff. It was also submitted that the Judge had been wrong in law in refusing to let the plaintiff give evidence that the lamp was defective.

The Court, however, held that it was not necessary for them to decide whether the fact that any particular lamp was out after dark was of itself evidence of negligence by the Local Authority; for the evidence the County Court Judge had was enough to justify him in saying that the fact that this lamp was out at the time was not due to any negligence on the part of the defendants or of the Lighting Company. The appeal, therefore, failed.

DAMAGES FOR INJURIES BY MOLTEN LEAD.

Yesterday (Monday) the Divisional Court, consisting of Justices Avory and Lush, heard an appeal by defendants from the judgment of his Honour Judge Parry in the action of *Crane v. South Suburban Gas Company*.* The action was brought to recover damages for injuries caused to a young child through a fire brazier, which was being used by defendants' workmen while repairing a gas-main, being overturned. The learned Judge gave judgment for the plaintiff for £25, and defendants appealed ,submitting that, unless some actual duty could be shown on their part, no action for negligence would lie.

It appeared that a trench about 9 feet long was opened in the road in order that the main might be repaired. Three men were sent to do the job, and the brazier was placed not in the roadway but on a forecourt. The Judge held that defendants were bound to absolutely protect children from the risk of the fire-pail being upset by anyone passing along the road. A number of children were watching the men at work; and they had been repeatedly warned to keep away from the fire. During the temporary absence, however, of the man guarding the fire, a boy coming along the street accidentally knocked against the fire-pail and upset it, and some molten lead went over plaintiff's foot.

Mr. Morton Smith having opened the appeal,

Mr. Justice Avory asked whether it was admitted that the fire-pail was not on the footpath.

Mr. Morton Smith said this could not be disputed. In all probability the public had a right over the forecourt; but the local authority could not claim it as part of the footway. He submitted, on the authority of *Cook v. Midland Railway*, defendants had not committed any breach of public or statutory duty, and that judgment should have been entered in their favour.

Mr. Justice Avory: Have gas companies express statutory authority to put a fire in the roadway?

Mr. Morton Smith: They have not; but they have a statutory duty to do all necessary work to repair pipes.

Mr. Justice Lush: Was there a duty on defendants to take reasonable care to prevent the fire on the highway becoming a nuisance?

Mr. Morton Smith said the fire, being a thing which everybody could see, there was no duty on defendants to put a guard to it. The accident would not have happened but for the accidental act of a third person.

Mr. Cassels, for the respondent, contended that, as the fire-pail was on a public footway, the defendants had been guilty of negligence, and, further, that, even though a fire was not in itself dangerous when it had a ladle containing molten lead on the top, it was a dangerous thing to put on the highway. The child was lawfully in the neighbourhood of the fire; and as the injury was caused by the molten lead, the Judge was perfectly justified in finding that the defendants should have put a guard, and, not having done so, were liable.

Their Lordships, in dismissing the appeal, said there was evidence upon which the County Court might reasonably come to the conclusion that what defendants were doing constituted, in the circumstances, a nuisance, in the sense that they were doing something on, or adjacent to, a highway which was dangerous to persons lawfully using it, unless proper steps were taken to guard against accidents.

The appeal was dismissed, with costs.

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* See "Journal," Vol. LXVII. p. 517.

* See "Journal," Vol. CXXXI., p. 296.

MISCELLANEOUS NEWS.

GAS COMPANIES' PROTECTION ASSOCIATION.

The Annual General Meeting of the Association was held last Friday, at the Westminster Palace Hotel, Victoria Street, S.W.—Mr. H. E. Jones, the Chairman of the Committee, presiding.

The following representatives of subscribing gas undertakings signed the attendance register: Mr. H. E. Jones (Chairman), Mr. D. H. Helps (Reading), Mr. W. Belton (Shrewsbury), Mr. A. W. Oke (Southampton, Winchester, &c.), Mr. Stanley C. Sherrard (Kingston-on-Thames), Mr. W. A. Schultz (Ascot), Mr. George Andrews (Swansea), Mr. George Clarry (Cardiff), Mr. F. W. Cross (Lea Bridge), Mr. R. Sandell (Lea Bridge), Mr. Hanbury Thomas (Sheffield), Mr. Thomas Waddom (Newcastle), Mr. C. F. Botley (Hastings), Mr. G. Stevenson (Long Eaton), Mr. Chas. W. Braine (Wandsworth), Mr. Gerald H. S. Iorns (Ilford), Mr. W. E. Roberts (Hornsey), and Mr. C. W. Offord (Tottenham).

The notice convening the meeting having been read,

The Secretary (Mr. F. E. Cooper) submitted the minutes of the meeting held on Oct. 22 last year; and they were confirmed.

Report of the Committee.

The following report of the Committee was taken as read:

The Committee herewith present the revenue account and balance-sheet, together with a report of the proceedings of the Association for the year ended Sept. 30, 1915.

The expenditure amounted to £939 15s. The revenue was: Subscriptions £607 19s., donations £5 5s., interest on Consols (less tax) £38 1s. 8d.—amounting together to £651 5s. 8d.; leaving a deficit of £288 9s. 4d.

The balance-sheet shows that the assets amount to £3826 10s. 1d., consisting of £1690 16s. 2d. 2½ per cent. Consolidated Stock at cost price—namely, £1522 11s.; £2300 4½ per cent. War Loan, 1925-1945, £80 per cent. paid, at cost—namely, £1840; balance at bank, £458 19s. 5d.; cash in hand, £4 19s. 8d. From this total of £3826 10s. 1d. must be deducted the amount owing to the bankers—namely, £2290—leaving a balance in favour of the Association of £1536 10s. 1d.

The Committee carefully considered the question as to the best means of discharging the liability for parliamentary and legal costs referred to in the last balance-sheet, and they decided that, instead of realizing a portion of the Association's investments at the depreciated price at which they were standing, they should arrange with the Association's bankers to advance the amount required for the purpose. This was accordingly done; and the amount borrowed duly appears in the statement of accounts.

The Committee decided to convert the Association's investment in 2½ per cent. Consolidated Stock into the £4 10s. per cent. War Loan, 1925-1945. For that purpose they subscribed for £2300 of the loan, and arranged with the Association's bankers, under the provisions of the War Loan (Trustees) Act, 1915, to advance the amount required to pay therefor.

The case of *Attorney-General (at the Relation of the Long Eaton Gas Company) v. Long Eaton Urban District Council*, which, as stated in the Committee's last report, was then under appeal, came before the Court of Appeal on Oct. 29, 1914, when the defendants' appeal was dismissed, with costs. The decision in this action is of a far-reaching nature, and has been followed in several cases (where a similar question was raised) which have come before the Courts since judgment in the action was given.

The Committee have given close attention to the difficulties experienced by gas companies (in consequence of the war) in obtaining an adequate supply of coal; and the President of the Board of Trade received a deputation consisting of representatives of the Committee and others connected with the supply of public lighting. This was followed by meetings of representatives of gas and electrical undertakings, held at the Electrical Institution, at which the Committee was represented.

Further, the Association formed part of an influential deputation to a very large number of members of the House of Commons, when the question was fully discussed and considerable impression made upon members of Parliament.

The Committee believe that these and other steps they took, in conjunction with the Institution of Gas Engineers and the Institution of Electrical Engineers, led to the restriction on export of coal, which secured a better supply.

The Committee are carefully considering the Price of Coal (Limitation) Act, 1915, so far as it affects gas companies.

Representations were made to the Board of Trade, and also to the authorities of the House of Lords and the House of Commons, with reference to the Statutory Companies (Redeemable Stock) Bill, which, as drafted, did not apply to companies promoting Bills for capital purposes in the present session of Parliament; and it was suggested, on behalf of the Committee, that the Bill should be amended so as to apply to capital authorized to be raised in the then present session. The suggested amendment was obviously necessary and desirable; but your Committee regret to state that, whether owing to the exigencies of time or pressure of Government work, the Bill passed into law without the amendment being made.

The following are the principal matters upon which the Secretary has been consulted during the past year:—

- Insurance of gas undertakings against war risks.
- Right of gas company to demand to place gas pipes and fittings in houses erected by local authority owning electrical undertaking.
- Mode of charging for energy supplied by local authority owning electrical undertaking.
- Right of gas company to refuse supply of gas to person who may be wrongly occupying house.
- Questions arising on quinquennial valuation list.
- Protection necessary for various gas companies in respect of Bills and Provisional Orders promoted in current session.
- Questions arising *re* damage to public lamps.
- Necessity of obtaining Treasury consent to raise capital and issue debentures.
- Liability as regards loss of meters by fire.
- Protection in respect of laying electric lighting mains in gas company's area.
- Questions *re* income-tax, depreciation, &c.
- Necessity of using new process for increasing the toluol contents of tar.
- Form of agreement with local authority as to breaking up streets for main laying.
- Increased contractors' rates for coal supplies.
- Repair of gas-mains under tramway.
- Inclusion of gas companies in Statutory Companies (Redeemable Stock) Bill.
- Alteration of dividend when affected by increased price of gas.
- Liability for damage to gas-lamp by improperly driven motor-car.
- Increased charges under sulphuric acid contract.
- Limited rate of interest on borrowed capital.
- Lighting contract with local authority.
- Anti-aircraft insurance rates.
- National Insurance Act—Part II., *re* gas-fitters.
- Subscription to Association as trading expense.
- Shops Act.
- Increased rate of interest on mortgages.
- Numerous and far-reaching questions *re* Price of Coal (Limitation) Act, 1915.

At the request of the Committee, a special circular, signed by the Chairman, was sent out to gas companies who were not members of the Association, pointing out the desirability of their joining it; and sixteen further companies have joined the Association during the year. The total number of members of the Association is now 138.

The Committee report with deep regret the death of Mr. Edward Allen, who has been a member of the Committee since 1908, and rendered valuable services to the Association.

The following members of the Committee retire in accordance with Rule 9: Mr. George Andrews (Swansea Gaslight Company), Mr. R. W. Edwards (Aldershot Gas, Water, and District Lighting Company), Mr. George Clarry (Cardiff Gaslight and Coke Company), Mr. Douglas H. Helps (Reading Gas Company), Mr. T. H. Hazell (Newport (Mon.) Gas Company)—all of whom offer themselves for re-election.

Mr. E. L. Burton and Mr. Thomas Waddom have been elected to the Committee in place of Mr. Edward Allen and Mr. W. F. Cotton, M.P.

Apologies for Absence—The Recent Indisposition of Mr. Charles Carpenter, D.Sc.

The Chairman remarked that a number of the representatives of subscribing undertakings could not be present. Letters regretting inability to attend had been received from Mr. Charles Carpenter, D.Sc., Mr. Berridge, Mr. Edwards, Mr. Kendrick, Mr. Hazell, Mr. Paterson, and Mr. Shoubridge. Their esteemed President, Sir Fortescue Flannery, Bart., M.P., wrote to say that he was very busy on munitions; and although he could not attend the meeting, he could assure them that he would always give his best services to the gas industry through the medium of the Association and otherwise. With regard to Mr. Carpenter, he had lately undergone an operation. But he had got through it, and had gone to Hindhead for a rest for a week or two, and would no doubt be back on Committee work very shortly.

THE LATE PROFESSOR LEWES.

In the last few days, the death had occurred of a very conspicuous member of the profession of chemistry, who was closely allied with gas. Professor Vivian Lewes broke down, and died in such a sudden manner that it was almost a tragic loss; certainly it was to those who were on personal and friendly terms with him. It was not more than eight or nine days before his death that he (the Chairman) met him on the Underground Railway, and he seemed to be as vivacious and full of health as a man could possibly be. He met him not as an old fighting adversary, but as a comrade in work, and in a most kindly way. He (the Chairman) thoroughly enjoyed the few minutes' conversation they had in the train. It was a melancholy thing to realize that so great a power of mind working in the industry had been removed from them, and so suddenly. No doubt some good brain would rise up to take his place; and the industry wanted all the science it could get.

ASSISTING THE NATION—A PROBABLE DEVELOPMENT.

Those in the room, for instance, knew how recently they had been called upon to aid in the defence of the country by the scientific application of the processes that were devoted to the supply of gas. From his position on the Munitions Committee (who were looking after the shots and shells, as well as other munitions), no one could realize more thoroughly than he did what an enormous assistance the gas industry had been rendering to the War Department in this crisis, and how it continued to do so. He was sure it was unnecessary for him to utter any words to appeal to the feelings of those present that they should take no selfish view of the position, either with regard to the amount of profits to be realized by making shells and fuses, or by preparing toluol. He was sure they would heartily feel with him, that in the nation's peril they should all do their very utmost. There was always some silver lining to the cloud. From what was going on, it seemed that there might be a development of the process; and he believed they might soon be called upon to carry it a little further. The fact that high explosives could not be produced without the aid of the gas industry, illustrated what a strong foundation the industry had already, and how strong it would be in the future. When representatives of the gas industry met nearly half the members of the House of Commons in the big Parliamentary Committee room, Mr. Carpenter told them that his personal connection with the question (those present knew that he was at Lord Moulton's right hand on the High Explosives Committee) entitled him to say that it would better become the position if the House of Commons, instead of asking the gas industry to go down on its knees to them to assist in getting coals on better terms, went down on their knees to the gas industry and asked it to give them the explosives the country so urgently needed. The effect of this statement on the body of legislators was very profound. They were also told that these essential products and residuals had been stored and looked after in Germany for years, whereas only recently, he was sorry to say, had the War Department called upon the gas industry for them. This again produced a profound impression upon the members of the House. To make a long story short, one outcome of the revelations to the House was the report of the Board of Trade Committee appointed to inquire into the causes of the rise in the prices of coal. From the report, those present would see how thoroughly the House of Commons were stirred to a consideration o this question on a proper footing. As had been pointed out at thei meetings by Mr. Botley and their friend from Sheffield (Mr. Hanbury Thomas), the position had become almost intolerable, in the getting o coal to carry on their business, and to keep the communities in a stat of safety, because to put a town in darkness would be to practicall give it over to plunder and rapine. However, he had started out t say that he hoped some good chemical authority would rise up to tak

e position rendered vacant by the death of their friend, Professor
ewes. They had already several eminent chemists in the industry;
d it was the wish of all to keep in the forefront of all the scientific
velopment that chemical research could afford to it.

THE ANNUAL REPORT—THE LONG EATON CASE.

e would now return to the report and accounts. The balance-sheet
owed a deficit of £288. The cause of this would be easily compre
nded if those present looked at the outgoings. In the parliamentary
ssion of 1914, they spent £537; and their contribution to the costs
the Long Eaton action amounted to £75. These were both heavy
ms, but productive of the greatest possible assistance to the industry.
the Association rested on the record of this one year alone, it ought
make it binding upon every gas company in the kingdom to see that
e organization was maintained in a position of equal efficiency in the
ars to come. The report dealt specially with the Long Eaton de-
ion. The parliamentary expenses, of course, had reference to the
ntest over the residuals clause, which the chemical manufacturers
ught to impose. But in regard to the Long Eaton decision, it would
seen how very far-reaching was its effect. In several cases, there
d since been an alteration of the policy in the matter of charging on
e part of municipal authorities supplying electricity; and they had
itted a position which they could neither logically nor legally defend.

THE SUPPLY OF COAL.

e Committee had also given close attention to the difficulty ex-
rienced in getting an adequate supply of coal. The effect of the
tion taken by a number of gas undertakings was that the Institution
Gas Engineers and the Association heartily co-operated—in fact, it
s practically through these Associations operations were conducted.
ey arranged the appointments for meetings with the electricity
rveyors and the municipal suppliers of gas and electricity. The
sition then was an extremely sad one. Their ships had been largely
ken away by the Government; and coals coming south by sea had
pay heavy freightage. The railways, too, were blocked up by the
litary authorities having commandeered the service; and he was
rry to say that sidings were maintained full of coal which might
st as well, without interfering with the military requirements, have
ne to the different gas depôts. A most difficult state of things was
ought about. Large stocks at works were reduced to a very dan-
rous and anxious minimum; and the lives of all connected with gas-
rks were made miserable from day to day. The view of the industry
s enforced upon Parliament that there should be restriction of the
ports, which, while weakening the supply to this country, possibly
ntributed to the service of the enemy, because coals were going away
neutral countries which, it was believed, were for the benefit of the
emy. While they were then hoping that Parliament would look into
is matter of the exports, they had little hope that Parliament would
induced to interfere in any way with the price of coal—they did not
pect this, however much they might have hoped it. In the result,
t only did Parliament restrict the coal exports (which at once set at
erty a large quantity of coal for home use), but they introduced a
ort Bill by which the colliery proprietors were prohibited from asking
re than the standard amount of 4s. additional per ton.

DIFFERENCE OF OPINION AS TO THE MEANING OF THE ACT.

hoped that those present had all got copies of the Act, because it
s likely to give rise to a dispute in which the Association would be
ch interested. He particularly wanted to draw attention to the
rding of the first clause:

> oal at the pit's mouth shall not be sold or offered for sale, directly or indirectly, by the owner of the coal, or on his behalf, at a price exceeding by more than the standard amount per ton the price of coal of the same description [he wanted to dwell upon the succeeding words] *sold in similar quantities*, and under *similar conditions affecting the sale*, at the pit's mouth, at the same coal mine, on the corresponding date (or as near thereto as, having regard to the course of business, may be practicable) in the twelve months ended the 30th day of June, 1914 (in this Act referred to as the corresponding price).

e Bill was very much debated in the House of Commons. The
lliery interests (which were not inconsiderable in Parliament) were
ry much against the passage of such a measure; and he thought all
nnected with the gas industry must have been very pleased to see
at Mr. Runciman, the President of the Board of Trade, in dealing
th many of the colliery proprietors' objections as to the measure
ving the interests of the rich gas companies, who were making un-
d profits, gave them the short and proper answer, that, under the
ding-scale, the larger part of any relief given to the gas companies
nt direct to the consumers of gas. This was true, because the part
any saving that the shareholders obtained was seldom more than
e-eighth, and in many cases was as little as one-tenth, and the re-
inder went in the reduction of the price of gas to the consumer.
did not suppose the Act was passed out of any sympathy with gas
mpanies, but out of sympathy with the host of consumers who used
through prepayment meters, and who were interested in getting
ir fuel at a fair and reasonable rate. One would have thought that
colliery proprietors after this would have been satisfied to obey the
t of Parliament. But, curiously enough, objections were raised, and
gular interpretations were put upon the clause he had quoted. Mr.
tley had put into his hand a note, which appeared to be the con-
ered opinion of the collieries, in answer to those gas companies who
pected, and naturally, that they would be charged only 4s. per ton
re than they paid during the year ending June, 1914. This was the
lieries' answer:

> If you desire to give formal notice of revision, it will mean that after Oct. 29 *each delivery* made to you will be treated as a *separate sale*; and the price chargeable will be ascertained *from day to day in comparison with the standard under the Act*, and the prices which ruled from day to day over the year ending June 30, 1914, and which we should advise you as each delivery is made the price chargeable in respect of such delivery.

his view, this was a threat. The note proceeded:

> You will also clearly understand that, if formal notice of revision is given, that revision must be carried out strictly in accordance with the procedure as set out in the Act. In this connection, we would remind you that comparative prices for some months ahead will be 1913-14 winter prices, also there was a three week South Yorkshire Miners' strike in April, 1914, when prices advanced abnormally.

The colliery proprietors professed to have had Counsel's opinion; and this was practically the result of it—that they were to expect to be paid for the contract quantity according to the day-by-day prices. It would be seen by the words of the Act that the view of the colliery owners was a distorted one—a view strained in their interests, and not conforming with the language of the clause. The price must be that of coal of the same description sold in "similar quantities" (that was to say, the annual quantity, and not a day-by-day driblet), and under "similar conditions affecting the sale" (that was to say, under an annual contract). The matter had been under the notice of the Committee; and they were advised (he himself had studied the matter, and had consulted an eminent Westminster Solicitor) that there was no foundation whatever for the pretensions put forward in the memorandum that had been received by Mr. Botley, nor for the *quasi*-legal opinion on the matter tendered to the colliery owners. Therefore, the Committee took the view (and he was sure they would have the full approval of the members) that, in the event of the point being seriously raised to the detriment of any subscribing undertaking, the Association would take up the matter, and would see that the gas industry was not imposed upon in the way suggested. Many of those present were engineers like himself, and knew what painful steps and what infinite trouble they had to take to effect some small economy which would possibly be equivalent to ½d. or 1d. per 1000 cubic feet; and then it was disappointing, and almost unnerving, at the end of the year, to find a fresh contract had to be made for coal at probably 1s. or 2s. per ton increase, which meant pence on the cost per 1000 cubic feet made. These increases in the price of coal were often made in the most irresponsible way. Prices fluctuated so enormously that those present would be amazed to hear that certain companies of which he knew actually entered into contracts for coal in the fall of last year—not at 4s. per ton in excess of the price of their then current contracts, but at 1s. below them; and these contracts were running to-day. When this was reported to him he was staggered, because he had thought that every colliery owner would have seen that the war would make coal more precious through the miners joining the army, through pit props and other things becoming dearer, through the shortage of ships and the blocking of the railways, and through the running-down of stocks, which conditions would mean that there would be no surplus coal. This and what followed showed the haphazard nature of these coal-price transactions. Was it right that coals furnished by natural conditions—coals that were a great national asset, supplying as they did the means by which the wealth and the prosperity of past years had been accumulated—should be at the beck and call of circumstances arising in quite a casual way? Was it right that these captains of industry should control the mines and a regular army of employees so badly that the country was everlastingly interrupted by disputes about wages, and under a system which provided that the higher the price that could be exacted from the consumer, the higher were to be the wages paid to the men? If the report was read of the Board of Trade Committee who inquired into the question of coal prices, it would be seen that there was also a most mischievous arrangement by which if, for coal supplied under a contract, the middleman could get another shilling per ton from the consumers, half of it was handed over to the colliery owner, though he was doing nothing more for it than supplying coals contracted for at a given price. He (the Chairman) recommended the report to the earnest consideration of every member of the Association; it would well repay careful reading and study.

PERMANENT COAL PRICE REGULATION REQUIRED.

For the condition of things which he had described, they had been looking for a solution. He had said at a meeting of gas shareholders that the gas industry ought to have bought its own collieries years ago. But they could not now get either the necessary capital or (he was afraid) the necessary sanction. Sir Corbet Woodall had struck a better note than that. He had asked why, seeing that Parliament regulated the gas industry, they should not regulate the profits on coal. The Act limiting the price during the war and for a period after, looked as though Parliament had now seriously considered something of the sort; and he thought they must all agree that this national asset of coal (which Mr. Asquith had described as the "life blood of the country," either for defence or peaceful prosperity) ought to be in some way controlled, and moved out of the arena of a game of battledore and shuttlecock between the colliery owners and the miners. He trusted that, so far as the members could influence their connections, they would make some such point as this, so that the conditions as to price might be put on some more permanent basis than they were at present. He had spoken at length on this matter; but it was a most important subject—in fact, it embraced quite a number of matters with which the Secretary and the clerical department had been dealing during the year. It would be seen from the list of subjects that had been handled by the Secretary (as given in the report) that the great bulk of the inquiries were all more or less relevant to the question of coal.

THE LATE MR. ALLEN.

The Committee had sustained a great loss by the death of Mr. Edward Allen, of Liverpool. He sat on the Committee since 1908, and had rendered valuable service. He was one of the leading men in gas politics, especially in the North of England; and he was sure the members would like to convey to Mrs. Allen and the family their deepest sympathy. A formal resolution was not required, as he knew that this was their wish. [Assent.]

THE COMMITTEE.

The report showed that there were a number of the members of the Committee to re-elect. They had also to appoint two members in the place of Mr. Edward Allen and Mr. W. F. Cotton, M.P. Mr. E. L. Burton and Mr. Thomas Waddom had been proposed; but he understood that want of time prevented Mr. Burton serving. This being so, perhaps it would be well to have a representative of Ireland; and he would suggest that Mr. Bruce Anderson be asked to fill the vacancy. He moved that the report and the accounts be adopted.

Mr. W. Belton (Shrewsbury) seconded the motion.

More Energy Suggested.

Mr. A. W. Oke said he represented some companies who were not at all pleased with the work that was being done by the Association. They felt that a great deal more might be accomplished; and perhaps more energy was required to do it. He spoke as a Director of the Southampton Gas Company. There had been some correspondence with that Company, who thought they might have received some little recognition from the Association in the fight they made to get the Northumberland clause inserted in the measure promoted by the Corporation in connection with their electricity supply undertaking. The Company felt rather strongly—rightly or wrongly—and there were other companies who entertained the same view, that there was insufficient energy put into the work of the Association. He held in his hand a copy of the Model Clauses; and there was a very extraordinary clause among them. It referred to directors of companies; and it read as follows:

> Notwithstanding anything in the Companies' Clauses Consolidation Act, 1845, no person shall be disqualified from being a director of the company by reason of his holding any office or place of trust or profit under the company, or by reason of his being interested in any contract with the company, nor shall any director be required to cease from voting or acting as a director by reason of his accepting any such office or place of trust or profit, or becoming interested in any such contract: Provided that in the case of his being or becoming interested in any contract with the company, whether such interest shall arise before or after his appointment as a director, the nature of his interest in the contract shall be disclosed by him at the meeting of the directors at which the contract is determined on if his interest then exists, or in any other case at the first meeting of the directors after the acquisition of his interest or after his appointment, and also in the next annual report of the company, and that no director shall as a director vote in respect of any such contract, and if he does so vote, his vote shall not be counted; but this prohibition shall not apply to any contract by, or on behalf of the company, to give to the directors, or any of them, any security by way of indemnity.

Here they had an Association for the protection of gas companies; and he took it this included the shareholders. He asked how it was the Association had allowed this clause to get on the Statute Book? Were they going to let it stay there? If they were entitled to the name of Gas Companies' Protection Association, the sooner this blot on the Statute Book was removed the better for all those concerned. There might be very occasional cases in which it might be possible for a director to be interested in the contracts of a company; but for (say) a principal, or a secretary or manager, of a firm, or a coal contractor, to sit on a board, and simply tell his colleagues——

The Chairman: May I ask if you have ever before called the attention of the Association to this matter?

Mr. Oke: No; and I am now speaking because nobody else has done so.

The Chairman: Personally, I sympathize with every word; and I am only sorry we have not had our attention called to this before. I should like to see the clause altered; and I think this would be the view of the Committee. Is that your grievance?

Mr. Oke said that was merely an illustration of what one's feelings were. He would not take up time with other matters, except to say that the debit in the accounts suggested they should have some skilled Accountant to give them the benefit of his audit.

Thanks from Long Eaton.

Mr. George Stevenson (Long Eaton) remarked that he should like to say how much his Company appreciated the service of the Association in the litigation in which they were concerned, and the matter connected with which had extended over some years. Although the contribution of the Association was small compared with that of his little Company, yet they were right glad to have to pay it, because the issues were clear enough; and his Company not only appreciated what the Association had done, but also the great personal interest taken in the case by the members of the Committee individually, and other prominent members of the Association. After all, in a matter of this kind, financial assistance was not everything. There were ways and means of rendering help in other directions. As had been truly said, the results of the case were far-reaching; and he thought it was quite an illustration of the fact that the Association was relatively of more benefit to the smaller of the undertakings, because obviously the larger gas undertakings were, in a matter like this, quite able to take care of themselves. For instance, it was rather a big undertaking for a small company to face litigation extending over many years. It seemed to him a great pity that more of the small gas undertakings were not members. He was glad to see they had sixteen new undertakings on the roll; he was sorry the number was not more. After the litigation was ended in which his Company were concerned, he had quite a lot of correspondence; and in every case he advised the companies to join the Association.

The Chairman said he was much obliged to Mr. Stevenson for his remarks. He liked to have an antidote close to the bane; and Mr. Stevenson's remarks came very appropriately after those of Mr. Oke. He was reminded by the Secretary that the provision which Mr. Oke had read from the Model Clauses need not be adopted by any company who did not want it. It was a surprise to him that those who advised the Houses of Parliament should have allowed such a clause to go into the Model Bill; and he would take an opportunity of calling attention to the matter. As to the Association not rendering assistance to the Southampton Company, he must take the whole blame. The position, however, was this: The Company did not succeed in persuading the Board of Trade to insert the Northumberland clause in the Corporation measure. Then they went to the House of Commons and did not succeed there. Then the Company, having got these two reverses, suggested that the Association might contribute to the further discussion of the question. He felt that the position was not one in which the Association could then assist; and, moreover, the Southampton Company was not a small concern like (say) the Long Eaton one, and it could reasonably afford to fight the question.

Mr. Oke: We won a precedent in the Lords.

The Chairman: All honour to you. Proceeding, he said that, regarding the suggestion that they should have a professional Auditor to examine the accounts, he would be glad it someone would volunteer to do this. Mr. Shoubridge was quite competent; but if someone who was a professional Accountant would help him, they would all be delighted. He saw Mr. Schultz present.

Mr. W. A. Schultz: I understand this is an honorary auditorship; and I shall be pleased to assist in the way suggested.

The Chairman: We will gladly accept Mr. Schultz's handsome offer.

The motion for the adoption of the report and accounts was unanimously carried.

Elections to the Committee.

Proposed by Mr. W. Belton, and seconded by Mr. Hanbury Thomas, the retiring members of the Committee were re-elected.

The Chairman then suggested that Mr. Bruce Anderson (representing Ireland) should be elected, subject to his approval, as a new member of the Committee, with Mr. Thomas Waddom.

Mr. Oke seconded this; and it was unanimously passed.

Vote of Thanks.

Mr. Hanbury Thomas, in proposing a vote of thanks to the Chairman, referred to his remarks on the coal question, and said he thought they might look upon it as the height of meanness on the part of the colliery owners that they should not have accepted the Coal Prices Limitation Act when passed. The colliery owners were now getting 8s. per ton more than they were doing on June 30, 1912; and in many cases more than that.

Mr. Oke seconded the motion; and it was heartily carried.

The Chairman responded; and this concluded the afternoon's proceedings.

MIDDLESBROUGH GAS-WORKS MANAGEMENT.

Present Arrangements to Continue.

After several animated discussions respecting the management of the gas-works, the Middlesbrough Corporation decided on Friday that the present arrangements at the works should remain undisturbed for twelvemonths. This decision was arrived at after a recommendation had been considered from the Gas Committee that the Manager (Mr. David Terrace) should be appointed Consulting Engineer at £250 per annum, and that the Assistant-Manager (Mr. C. T. Blencoe) should become Manager at £300 a year.

Mr. E. Spence objected to this recommendation, remarking that he thought both Mr. Terrace and Mr. Blencoe should have resigned, so that they could have had a clear start.

Mr. Scholes said the Corporation were no longer manufacturing gas. The works were now simply a distributing centre; and he could not see the necessity for two officials.

Alderman Hinton spoke highly of Mr. Terrace's abilities as a gas manager, and of Mr. Blencoe as a chemist.

Mr. Trevelyan Thomson pointed out that they were possibly the only Committee in the country who had not had to increase the price of gas. They were making probably £6000 or £7000 a year more than they would have done if they had not had the present management.

Mr. J. Calvert (the Chairman of the Committee) said that, but for his keen desire that Middlesbrough should have good and cheap gas economically produced, he would have resigned from the chairmanship of the Committee. Without desiring to do so, members of the Council were seeking to do an injustice to two excellent servants. He pointed out the many difficulties which had to be overcome in effecting the change to the utilization of coke-oven gas, and said that nobody could have possibly carried out the engineering work more perfectly than Mr. Terrace had done. He understood gas engineering as thoroughly as any gas engineer in the country. Mr. Blencoe was also a capable engineer; and in the two they had ideal officials. But for the new arrangement for the utilization of coke-oven gas, they would have been paying at least 4d., and probably 8d., per 1000 cubic feet more for their gas. Messrs. Terrace and Blencoe had been responsible for bringing about these beneficent changes; and they were working for an aggregate salary less than that paid in a neighbouring town with only two-thirds of their output of gas. What Middlesbrough ought to have done in recognition of their recent work was to grant each an advance of £200 a year. They had now far more need than before of a manager with a knowledge of chemistry.

The Council first of all adopted a proposal that the matter should go back for further consideration, but afterwards agreed to an amendment as above.

Birkenhead Gas-Works and the Rates.—In the course of discussion on the Gas Committee's minutes at a meeting of the Birkenhead Town Council last week, Alderman Oldam said they had been told there would be a surplus on the working of the gas undertaking, when it was known there would not. The Chairman of the Gas Committee (Alderman M'Gaul) replied that 1870 lamps had been extinguished, which meant a saving of £2000. In addition, there had been a reduction in the amount of gas consumed, which was further accentuated by the earlier closing of places of entertainment. If a good season was experienced, the Gas Committee would fulfil their promises to the Town Council to give something towards the rates. Alderman Oldam retorted that the last speaker was misleading them. The Gas Engineer (Mr. T. O. Paterson) told him that, in consequence of the increased price of gas, £2000 would be given towards the rates. What had happened? There had been a reduction of 3 per cent. in the consumption which was not represented by £2000. Alderman M'Gaul would find he had under-estimated the price of coal and over-estimated his profits; and it was not fair to say that the loss was through the reduced number of lamps.

EVIDENCE ON FACTORY LIGHTING.

When the Home Office Departmental Committee on Lighting in
actories and Workshops [*ante*, pp. 98, 149, 209] assembled for their
xth sitting, on Oct. 23, 1913, some evidence was given, in the first
lace, on behalf of the London Chamber of Commerce.

Mr. *H. L. Symonds*, Chairman of the Manufacturers' Section of the
ondon Chamber of Commerce, and of the Special Committee ap-
ointed for the purpose of giving evidence in the inquiry, said his
ommittee were of opinion that the task of defining a standard or
andards of illumination, even by means of a careful classification of
rocesses, was quite impossible, in view of the vast number of pro-
esses employed, the variety of artificial light, the possibility or other-
ise of obtaining that which was most suitable, the variety in the
ape, size, and position of buildings and workshops, and the require-
ents of individual workers. He himself was strongly of opinion that,
en if the object to be attained, admirable as it was in itself, were
herwise feasible, the difficulty presented by the individual would be
surmountable. He did not think anyone could resist modifications
the Factory Act stipulating that lighting should be "adequate;" but
en there would be the difficulty of interpretation. Light was so
eap nowadays, that he imagined there was not any question of ex-
ense standing in the way with the majority of employers.

Mr. *John Carr*, of Messrs. Peek, Frean, and Co., Deputy-Chairman
the Manufacturers' Section of the London Chamber of Commerce
d of the Special Committee already referred to, expressed the opinion
at it was not possible to arrive at a standard, as conditions varied to
ch a great extent in different factories; and it would be equally im-
ssible to classify processes in relation to illumination required.
here strong light was not required, it was important that the general
hting should be of low intensity, and thus obviate the danger of
ong shade; and from the point of view of the workman, and the
nger to eyesight, it was highly desirable to avoid any demand for
cessive lighting. Again, in shops where individual lighting was re-
ired, it would serve no useful purpose to raise the standard of illum-
ation over the whole place. In some factories processes calling for
dividual lights and others needing only general lighting were carried
side by side—thus increasing the difficulties of creating any standard.
would, however, be an excellent thing if the Committee could see a
y to establishing a standard. Even if a standard were fixed, he saw
eat difficulty in maintaining it. Speaking of the matter generally, it
emed to him there was a possibility of small workshops having all the
cessary lights, and turning them on when the inspector came to the
tes. He had been in a great many American factories; and the
ature in these was a strong diffused light. Alluding to his own fac-
y, it was extremely difficult for the bakers to get an artificial light
ich enabled them to see whether the material was properly baked.
r instance, he tried mercury vapour lamps, and everything produced
s defective.

Mr. *S. A. Russell*, a member of the Electrical Section of the London
amber of Commerce, Engineer and Works Manager of the India-
bber, Gutta-Percha, and Telegraph Works Company, stated that
e fixing of a standard of intensity of illumination of so many candle-
t, which would have to be determined by a photometric measure,
uld present many difficulties, owing to variation in the nature of the
rk, in the colour and quality of the surface to be worked on, and the
gle of incidence of the light on that surface, and more especially
ing to the fact that the personal element entered largely into the
estion of what constituted a satisfactory illumination. No doubt,
e object of any proposed standardization was to reduce as much as
ssible the strain on the eyes of the workers; but, in his opinion, the
ing of an absolute standard of illumination for any particular class
work would defeat this object, on account of the varying require-
nts of different workers. The suitability of a given intensity of
mination on the work was also affected by the method of lighting.
the lighting was effected by means of lamps of fairly high candle
wer some distance apart, it would often be that neighbouring objects
re more brightly illuminated than the work on which a particular
rson was engaged; and when this was the case, the fact that the
rker's eyes might meet a brighter light when they were turned from
e actual work would render the illumination of the work less satis-
tory than it would be if the intensity of the illumination on the work
re less in candle-feet, but the lighting was so arranged that the
rrounding objects were lighted to the same or lesser intensity. Then,
considering the question of how to fix a standard of illumination for
rticular machines in an engineering shop, one was met with great
ficulties owing to the variations in the work done on one machine.
ke, for instance, an ordinary screw-cutting gap lathe used for general
rk. The bulk of the work might be plain turning, and the lighting
ght be arranged for such work, so as to give the specified candle-
t intensity. But the machine was also used for facing, boring, and
ew-cutting, both external and internal. Was the manufacturer to
ovide lighting that would give the same intensity in candle-feet at
e point of the tool for any of these operations? When cutting a
t-hand internal screw, he might require to see an indicator on his
de to set the amount of cut, and also to watch the position of a fixed
int on his work in relation to a fixed point in the gears of his
chine. Was the same intensity of illumination to be provided at
h of these working points? If so, the manufacturer would have to
ovide perhaps three times the lighting required for ordinary work,
as to be ready to fulfil the specified conditions on these occasional
s. Similar questions arose in connection with most machine tools;
d in his opinion any attempt at specifying a standard of illumination
uld fail, either because it did not cover all the different conditions
working, or because it entailed the provision of much more intense
mination than was generally required or desirable. It might be
ssible to fix a standard for some factories where the lay-out con-
ted of a number of identical machines doing the same work, though
en in such a case the same intensity of illumination might not suit
workers. But in an engineering shop the conditions varied so much
t the fixing of a standard became impracticable. The conditions
re best met by the provision of lamps the position of which could be adjusted by the worker; and when this was done, there was no use for a standard, as the worker would adjust the lamp to please himself, whether or not the intensity of illumination was in accordance with the standard.

Mr. *Robert Girvan*, Secretary of the Scottish Operative Tailors and Tailoresses Association, gave particulars with regard to the working conditions in the trade, particularly from the "underground" and ventilation point of view. He said there were a number of workshops satisfactorily fitted with incandescent gaslight. The men liked this; but so far as he could gather from those who used it, they considered electric light was the best, on account of the absence of heat.

Mr. *W. H. Hughes*, representing the Fine Cloth Manufacturers Association, stated that in the home of the trade, Huddersfield, several kinds of illumination were in use; but the general opinion was in favour of electricity. Taking the electric light as a basis, they thought that in front of each weaving loom there should be at least two 16-candle shaded metallic filament lamps. The looms were back to back; and there should be one 16-candle power lamp behind to serve for two looms. If the lighting was taken solely into consideration, he thought incandescent gas would be regarded as the better illuminant; but there were objections in the shape of expense. Mantles were often broken by the vibration of the machinery; and there was also the effect on the air. He believed it would be possible to frame, in terms of candle power, a regulation as to the actual amount of light which ought to be on the loom or work table.

Mr. *Alfred Smalley*, Secretary of the Operative Bleachers, Dyers, and Finishers Association, did not think it would be possible to define and establish a standard or standards of adequate illumination suitable for the various operations and processes in the trades he represented. It was necessary that more effective illumination should be supplied to the vital parts of all finishing machinery and making-up processes as distinct from preparatory processes. It was impossible to consider factory lighting apart from the question of the removal of steam and dust from departments where these special difficulties were the result of the processes carried out. In his opinion, electricity was the best artificial light, provided naked lights were not placed in such positions as to be in the line of vision. There had been a special process of what was known as artificial daylight instituted in dye-houses on a small scale for the shading of colours. It was not necessary, however, to instal this particular process of artificial lighting throughout the works.

Mr. *Robert King*, representative of the Light Castings Iron Founders Association, expressed the opinion that the fixing of a common standard of lighting, to be made applicable to all foundries, irrespective of the circumstances of each case, presented great difficulties. It was in relation to artificial light and its efficiency that the greatest difference of opinion probably existed. The employer might be trusted in his own interest to provide sufficient illumination to enable the workman to turn out the maximum work. The present tendency, in the absence of any regulations, was towards improved systems and an improved standard of lighting. Should a uniform standard be devised and adopted, the employers would claim freedom in their choice as to the nature of the illuminant and the lamp that they considered best suited to their needs. Already, in many works, expensive systems had been installed which might otherwise have to be discarded at considerable loss. The members of his Federation regarded as too high a standard for moulding shops the suggestion that "the lighting should not be deemed to be adequate unless the illumination intensity on the horizontal plane 1 foot above the floor is not less than 0·3 to 0·4 foot-candle over any part in which work is being carried on, or over which any person is liable to pass." In view of the fact that lamps of higher candle power than that requisite to give the standard illuminating intensity would have to be provided on account of the effects of wear and tear, variation, &c., in the supply, a standard of 0·2 foot-candle should be considered sufficient. As no standard of lighting had hitherto existed, and as there was considerable diversity of opinion with regard to a suitable standard, the employers submitted that the standard should, to begin with, be fixed low rather than high, in order to prevent what might prove to be an unnecessary expenditure.

Dr. *F. W. Edridge Green* thought it was much more important to have the lighting as uniform as possible, than to have it of a particular candle power. It would be desirable to introduce regulations with regard to adequate lighting in factories such as obtained in Holland, and also with regard to the component character of the light. The conclusion he had come to was that any system of lighting which would produce a bad photograph through variations in intensity was defective. This remark only applied to photographs which represented what was actually seen. One could take a photograph with the ultra-violet or the infra-red rays. The eye was able to see comfortably within large variations of general intensity, just as a good photograph could be taken in similar conditions; but systems in which there were relatively bright points or objects in the field of vision, as, for instance, the sun or a naked light, were to be avoided. A light in a factory should not have a shade like a reading lamp; it should be arranged so that the illumination was spread.

Mr. PATERSON: Have any actual cases of harm to the eyesight come under your notice, and have you actually traced it to people who have worked in bright patches of light?

Witness: Oh, yes; in the mercury arc light there are cases where very definite disease has been produced.

The CHAIRMAN: I think if we could have a note of the cases of disease caused by glare, apart from the mercurial arc lamp, it would be useful.

Witness: There are several cases.

Mr. PARSONS: We can get plenty of cases of gross retinal disease contracted from intense light. But it is with regard to the actual harm caused in these general places by glaring light that we wish to know. It is difficult to find a case in which any positive harm has resulted directly from such a cause. One gets tired, and so on; but there is no positive proof that working in a room day after day in a strong light produces retinitis.

Mr. *F. Lockyear*, representing the National Council of the Iron Founders Society, expressed the opinion that for foundries high-pressure gas was really the best light.

Mr. *C. Wardle*, Secretary of the Amalgamated Society of Operative Lace Makers, stated that there were three branches of his trade; and in his opinion the establishment of a standard system of lighting—which would be practically the same in each case—could be easily accomplished. A few firms now had high-pressure gas, and some ordinary incandescent lights; but the majority of firms had taken to electricity. Some firms were quite generous with the lighting—in fact, there were instances in which it was a matter of opinion as to whether the illumination was not too good.

Mr. *W. Hartshorn*, representing the hosiery knitters in Nottinghamshire, said the present system of lighting varied in different workshops—gas, five lights of 8 to 15 candle power per machine; Keith light pressure, two lights of from 45 to 90 candles per machine; and electric lights. Generally the lights were fixtures, and placed in any but the best positions. What was wanted was not two lights of high candle power, but more lights. A suitable standard would be one 20 to 25 candle light to every 5 feet of machine; the lights to be on pulleys, so as to be movable to any position. The lights should be shaded.

Mr. *J. Allen*, of the National Federation of Merchant Tailors, stated that he had just inspected an up-to-date workshop where there were adjustable flexible tube gas-fittings; and the lighting was very good. He should say the candle power would be perhaps 30 candles per man, which would be quite ample. In fact, he thought a couple of men could work very comfortably indeed with a 30-candle power burner close to them. His federation would agree with some rule or regulation that the workshops should be adequately lighted. They preferred gas to the electric light, because it was said to be less trying to the eyes. The general feeling was that a man could work longer and more comfortably with a good incandescent gas-burner than he could with electric lights. He thought this had applied specially since the new metallic filament lamps had come in. The introduction of electric light was a great disappointment to the trade. He thought that they were going to have daylight all the time, and would be able to distinguish colours equally well with the electric light as with daylight; but they found this not to be so. As to the preference for gas, perhaps he ought to amplify this. The electric light had not been very closely tested. In fact, he did not know any workshop where they had absolutely taken out an electric light after installing it. It had been rather, he thought, on the part of foremen and employers than the workmen that these experiments had been made. They had had electric light in their cutting-rooms, and had tried sewing there; and it was rather in this way the opinion had been formed that incandescent gas-light was better than electricity.

Mr. *T. E. Ritchie*, of the Testing Department of the Union Electric Company, who had given evidence earlier in the inquiry [*ante*, p. 209], was called for further examination. He produced a photograph of a factory where improved lighting had been installed, and said the average earnings of the girls throughout the year were increased by over 11 per cent. with the better light. The cost of the lighting amounted to about 4 per cent. of the cost of manufacture; so that there was a distinct gain. This was a case of indirect lighting. The work was dress making. In another instance, where the work was unusually fine [in connection with artificial teeth], a system of direct lighting was found quite inadequate, though the original value had been increased by putting into the lamp-holders higher candle-power lamps. The lamps were then lowered in position until it was found that each of the girls was getting approximately 20 foot-candles over the smaller area in which she worked with her hands. When this point was reached, the light was satisfactory, though it was very difficult to avoid glare troubles; and the girls also complained of the heat. Experiments were then made with indirect lighting; and it was found that the illumination could be decreased considerably. The extent to which this could be done varied a good deal with the workers; but they were all perfectly satisfied that they had enough with 14 foot-candles, as against 20 foot-candles. The 14 foot-candles with indirect lighting really represented the mean in the room, because with this system it was, of course, impossible to light a small spot. Referring to figures produced by him regarding an old and a new electrical installation, he said the total energy required for the new lighting was exactly two-and-a-half times that for the old. Any commercial undertaking would be likely to at once object to such an increase as this; and to be prepared for these objections, the precaution was taken of making some very careful time-tests of typical operations. These were taken both under the old and the new lighting, and as far as possible without the knowledge of the people who were being tested. One operation with the old lighting took 5 minutes 40½ seconds, and with the new 4 minutes 25½ seconds. In another case the figures were respectively 3 minutes 30⅗ seconds and 2 minutes 58⅗ seconds. This was an average in each case of eight or ten tests, with girls admittedly experts. His experience generally was that in this class of work indirect lighting was superior.

The CHAIRMAN: So far as we have gone, the evidence has been to show that for certain kinds of work, the workers require a higher illumination from indirect than from direct lighting, which, of course, is contrary to your result here. What I mean is a higher illumination over the actual work.

Witness: Well, that is quite contrary to the experience of my Company and myself; and it is also quite contrary to many instances published by others.

By means of a diagram, witness next proceeded to explain a series of tests carried out in an attempt to "solve the very vexed question" of whether one does or does not require more or less illumination to perform the same work when it is applied directly or indirectly. The results were that with 0·4 foot-candle indirect lighting, out of seven individuals, six read certain words and figures easily, and one failed. With 5·6 foot-candles direct lighting, five read the words and figures, and two failed. The light in one case was, of course, fourteen times as great as in the other. From these experiments, he suggested that the Committee should allow a reduced actual illumination for total indirect lighting. But they must differentiate very carefully between this and the various methods of semi-indirect lighting. His Company, for instance, made arc lamps for certain classes of indirect lighting with which the results of the tests he had just referred to could not be obtained. Immediately more than a very small proportion of the light was allowed to be transmitted directly—more than, he should say, 10 or 12 per cent.—one began to get reflection troubles, and difficulties of this character; and the illumination had to be put up.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

On Thursday of next week, the 11th inst., the half-yearly ordinary general meeting—the 167th—of the proprietors of the Association will be held at the Cannon Street Hotel.

In the course of the circular convening the meeting, the Secretary (Mr. R. W. Wilson) states: The Directors have been able, since the date of the last general meeting, to complete the returns from the stations and to prepare the accounts for the half year ended June 30, 1914. These accounts have been duly audited; and I have to hand you a copy of the Directors' report upon the results of that half year. With regard to the half year ended June 30, 1915, the Directors regret that, owing to the absence of returns from the stations, it will not be possible to prepare a report, balance-sheet, &c., in respect of that half year. They regret they are not in a position to recommend the declaration of a dividend in respect of the half year ended June 30 last.

The report of the Directors referred to above—signed by the Chairman, Sir Charles J. Jessel, Bart.—is as follows:

The profit of the half year was less by £67,349 than that of the corresponding half year of 1913, and amounted to £219,130, which, together with the sum of £13,435 brought forward from the previous half-year's account, makes a total of £232,565 available for appropriation, as compared with a profit of £286,479, and an available total of £305,047 on June 30, 1913.

The distributions to the proprietors of 2¼ per cent. in November, 1914, and in May, 1915, have absorbed £222,300 out of the amount which was available for appropriation on June 30, 1914, leaving a balance of £10,265.

The total output of gas in the towns supplied by the Association increased in the first half year of 1914 by 3·27 per cent., or about 192 million cubic feet. The number of consumers on June 30, 1914, was 517,090, or greater by 6·91 per cent. than at the close of the corresponding half year of 1913. The total number of meters in use at the end of the first half year of 1914 was 579,666, of which 190,600, or 33·05 per cent., were prepayment meters. At the end of June, 1913, the total number of meters in use was 550,551, of which 174,118, or 31·63 per cent., were prepayment meters.

The plant and mains at all the stations were maintained in their usual efficient condition.

The quantity of coal carbonized in the first half year of 1914 was 480,022 metric tons (or 6283 tons more than in the corresponding half year of 1913), at an average gross cost delivered on to the works of 19s. 6d. per ton, or 1s. 10·68d. per ton more than in the first half year of 1913. The oil used for the manufacture of water gas amounted to 2539 tons, or 293 tons more than in the first half year of 1913. The value of the coke produced was lower than that realized in the corresponding half year; but tar showed an improvement. The values of ammoniacal products showed a considerable decrease.

The following new exclusive contracts for the supply of gas were concluded with Suburban Communes of Antwerp—viz., Kessel, Santhoven, Viersel (until Dec. 31, 1948), Rijckevorsel, and Wuestwezel (until Dec. 31, 1949).

At Berlin, the contract with the Suburban Commune of Rosenthal was prolonged until Jan. 1, 1985; and in Selchow (also a Suburban Commune of Berlin) a monopoly of the supply of gas until Dec. 31, 1962, was secured.

An exclusive contract was concluded at Brussels with the Commune of Ruysbroeck until May 1, 1944; while the contract with the Commune of Zellick was prolonged until Sept. 1, 1949.

At Hanover, a contract for the supply of gas in the Commune of Vinnhorst, until July 1, 1950, was obtained.

At Antwerp good progress was made with the construction of the fourth bench of vertical retorts on the Berchem works; while on the Hoboken works, the foundations of a new retort-house were taken in hand.

An extension of the telpher plant at the Mariendorf works at Berlin was completed.

At Brussels, the new electrical coal-handling plant on the Forest works neared completion.

The need for additional office and show-room accommodation at Hanover having made itself evident, it was decided to rebuild the premises in the Osterstrasse. The old building was demolished in January; and on June 30, 1914, the shell of the new building had been completed and roofed-in.

COLOGNE GAS UNDERTAKING.

Report for the Year 1913-14.

The report on the working of the Cologne Corporation Gas, Water, and Electricity Departments for the twelve months ending March 31, 1914, has just been issued. The following particulars relating to the gas undertaking are taken from it.

The total output of gas from the works amounted to 56,013,725 cubic metres [1978 million cubic feet], which is an increase of 5·32 per cent. on the output in the preceding twelve months. It corresponds with a consumption of 3593 cubic feet per head of the population in the area supplied. The Ehrenfeld works of the undertaking produced 97·11 per cent. of the total production of gas; the remainder being made at the Kalk works. At the Ehrenfeld works 58 per cent. of the production was from vertical retorts, and the remainder from inclined retorts. At the Kalk works only two settings of horizontal retorts were in operation. The gas made at both works consisted of coal gas, with the exception of 17,494,664 cubic feet of water gas made at the Ehrenfeld works, which was used for the manufacture of hydrogen required for aeronautical purposes. The make of gas per ton of coal carbonized was, in the inclined retorts, 12,200 cubic feet; and in the vertical retorts, 14,337 cubic feet.

The quantity of saleable coke produced amounted to 59·15 per cent.

he coal carbonized. The production of tar, including retort-house ch, amounted to 5·01 per cent. by weight. The sulphate of ammonia ounted to 1·11 per cent. by weight of the coal carbonized. Its aver- content of nitrogen was 20·11 per cent.

here were 14,803 public lamps, containing 17,359 burners. Of se about 7700 lamps have been equipped with distance lighting de- es, of which four different systems were employed. High-pressure lighting was further extended—a total of 191 high-pressure lamps ng in operation at the close of the year. The average gross calorific ver of the gas supplied was 534 B.Th.U. per cubic foot at 60° Fahr., nches, and saturated. Its average illuminating power in the argand ner at a consumption of 5·3 cubic feet per hour was equal to 8·6 glish candles. The gas also contained on the average 20·6 grains of hur and 9·1 grains of cyanogen per 100 cubic feet. The average nposition of the gas, in volumes per cent., was as follows : Carbonic l, 2·3 ; oxygen, 0·4 ; heavy hydrocarbons, 2·9 ; carbonic oxide, ; hydrogen, 52·5 ; methane, 26·6 ; nitrogen, 5·1. The flue gases n the retort-settings contained on the average 19 per cent. of car- ic acid.

he quality of the coal supplies was checked in the experimental gas nt, in which also several new descriptions of coal were examined. naphthalene washers, which were charged with vertical retort tar, iced the mean proportion of naphthalene in the gas from 9·6 grains 5·2 grains per 100 cubic feet. A new method of working the fiers, which had been adopted in the previous year, continued to good results—the proportion of prussian blue in the spent oxide ng to 8·01 per cent.

he price of gas for lighting, heating, and cooking purposes, was f. per cubic metre [3s. 8d. per 1000 cubic feet], with rebates to e consumers increasing according to the quantity consumed until, ne case of a consumption exceeding 250,000 cubic metres [8,829,000 c feet] per annum the price becomes reduced to 8 pf. per cubic re [2s. 3d. per 1000 cubic feet]. Gas consumers having several es of business are allowed to claim rebate on their total con- ption. In the case of prepayment meter supplies in which the ices, meters, and fittings remain the property of the gas under- ng, the price charged is equivalent to about 18 cubic feet for 1d.

◆

GAS AND ELECTRICITY SUPPLY AT PARÁ.

he interests of both the gas and electric lighting of Pará (Brazil) under the control of the International Lighting Association, a ting of the proprietors of which concern was held in Edinburgh Thursday, the 28th ult.

he report presented for the year ended Dec. 31 last showed a net it of £1120, which, added to the amount brought forward, made 15. After paying a dividend on the preference shares for the year, e was left £2192, which the Directors recommended should be ied forward—subject to Directors' fees.

March of the present year the Pará Gas Company sent its share debenture holders a communication referring to the decreased its of the Company, which had resulted mainly from the unsatis- ory condition of trade in Pará, occasioned by the competition of tation-grown rubber with the wild rubber from the Amazon, and he more severe competition of the Pará Electric Company. As Gas Company could not continue operations as an independent ern unless additional funds to a substantial amount were forth- ing, the Directors of the Company considered it advisable to oach the Pará Electric Company ; and as a result of their negotia- , the Electric Company entered into an agreement to take over gas undertaking on terms the acceptance of which the Gas Com- Directors strongly recommended to their share and debenture ers.

the exchange of the Pará Gas Company shares for preference es of the Pará Electric Company and cash, the accounts of the ciation to Dec. 31 next will show a considerable loss of capital ; the Board are advised that before further dividends can be paid on share capital of the Association the loss must be provided for, either ccumulating revenue or by reducing the capital of the Company.

ne Directors accordingly were unable to make payment of any divi- l on the preference shares for the half year to June 30 last, and proposed that the ordinary shares of the Association should be re- ed from their present nominal value of £1 to 5s. per share.

fter consultation with some of the principal shareholders, the Direc- recommended as a reasonable arrangement between the holders ne preference and ordinary shares respectively that, as from July 1 the preference shares, in place of a dividend of 6 per cent., as at ent, should be entitled to a cumulative preferential dividend of 5 cent. per annum, with the right to receive a further 1 per cent. per um in any year after a dividend equal to 10 per cent. per annum been paid on the reduced value of the ordinary shares—equivalent per cent. on the original nominal value of the ordinary shares.

◆

Advance in Wages at Sheffield.—As the result of a meeting veen officials of the Company and representatives of the employees, Sheffield United Gas Company have agreed to grant a further all- nd advance of 1s. per week, which makes 3s. in all that the Com- y have given their workmen since the outbreak of the war. The ance will affect about 1200 men and boys, and means an annual enditure of £3000. It is said to bring the Sheffield gas-workers to highest rate in the country ; the lowest minimum rate being for the works labourer 29s. per week, which includes the 3s. war bonus. h regard to the gas-fitting department, Mr. Hanbury Thomas (the aging-Director) pointed out that the maintenance section was not ied on to any great advantage to the Company ; and in the present s he thought the public should attend to their own stoves and ing, so as to liberate a number of men for the making of muni- . The men's chief ground for the application was the continued eased cost of living.

DANISH GAS COMPANY.

The Annual Meeting of the Company was held last Thursday, at the office of the London Agency, Millbank House, Wood Street, Westminster, S.W.—Sir CORBET WOODALL, D.Sc., in the chair.

The LONDON AGENT (Mr. H. G. Warren) read the notice convening the meeting, as well as the minutes of the last annual meeting. It was also agreed that the meeting should be held in London.

THE GERMAN STATIONS.

The CHAIRMAN said, before proposing the formal resolution that the report and accounts be received and adopted, he felt it more than ever necessary that he should make a few observations in explanation of the situation. The past year was one of conditions so abnormal that comparison with that (or those) immediately preceding it could not help much in arriving at a conclusion as to the efficiency with which the work of the undertaking had been carried on. To commence with, they were deprived of the fruits of their labour at Flensburg and Ribnitz—the two towns in Germany supplied by the Company. The management of these two stations was still being conducted by their own staff, but under the supervision of a German controller. Mr. Edwards, whom they were glad to see present, would tell them something of how this was done. The broad fact from the shareholders point of view was that the money earned over the expenses incurred remained in the banks of these towns, and would be dealt with when the war was over. Meantime, it had no place in their accounts; and the profit-earning power of the Company was reduced proportionately.

COAL, CAPITAL, AND GAS CONSUMPTION.

As the shareholders were aware, the Company had shared the difficulty common to all the world of obtaining a sufficient supply of coal at an even tolerable rate of charge. The stocks had been so low as to cause the Directors and officers considerable anxiety ; and they had paid prices which only dire necessity could justify. The line of policy adopted by the enemy towards unarmed ships—British and neutral—pressed the cost of freight up from 4s. 6d. to 25s. per ton ; so adding a further heavy burden. What the future would bring was difficult to say ; but if Denmark was not drawn into the war—and this seemed very unlikely—he did not think there was much to fear. Denmark had shown that it intended to keep neutral ; and he hoped it would succeed in doing so. Apart from coal, all the materials the Company needed had been increased in price, and, in addition, the output of gas had fallen off. Considerable expenditure of capital upon extensions of works and upon enlarged and extended mains had been reported recently. This outlay had been needful, because of the steadily increasing demand for gas which had marked recent years. Now, however, when the capital was to a large extent spent, the gas consumption had, as he had said, fallen off, and with it the revenue which should have been forthcoming for the payment of the dividend on the capital. This summed up the chief difficulties that had had to be faced during the past year, and had still to be faced in the year now current. Against this, they had the advantage (to which he had referred more than once), under their contracts in Denmark, of being able to adjust the prices charged for gas to the consumers to the cost of coal above or below a certain fixed standard. At the present time, the charge was higher than normally; but when burdens upon all were so heavy in Denmark, as well as in England, the Directors had not felt justified in availing themselves of this condition to the uttermost. He was glad to say here that they had reason to be thankful that the control of the coal exported from this country had been so ably managed. The task was a most difficult one, and might have caused much confusion and perplexity.

THE TEST OF FIGURES.

Bringing these matters to the test of figures, he might say that on manufacture they were £8183 behind last year—that was to say, the cost of coal, &c., had increased by £22,878, and the decrease in the sale of gas (allowing for the increased price chiefly on one quarter) had meant a loss of £938—a total of £23,816 to the bad. Against this they had been able to set certain economies in repairs, reduction in wages—that was to say, in the total wages, not in the wages paid per man—and improved value of residuals, amounting to £15,633. The difference between these figures was the £8183 he had mentioned. Loss on exchange had cost them £3068 more than in the previous year ; and they had transferred £5000 less to the reserve and redemption account than they had done in several recent years. On balance, there was £9015 less than last year available for dividend.

"LESS INCOME-TAX" RESERVES AND WORKING CAPITAL,

When coming to the determination to recommend that the dividends paid this year should be "less income-tax"—*i.e.*, that the burden of income-tax should fall upon the shareholders and not upon the Company—the Directors had been governed by a desire to provide against possible further losses in the future. Letters had been received from shareholders calling attention to the large sum carried forward, and urging that this would justify more liberal treatment. He did not think it was quite realized that, apart from the amount which was invested, for security's sake, outside the Company, the various reserves were employed as working capital in the undertaking. Looking to the balance-sheet, it would be seen that the capital raised was less than had been spent by £152,618 ; so that the Company had not only no working capital, but there was this large sum as a debit. Needless to say, it would be impossible to carry on under such conditions, were it not for the reserves. To dissipate them would involve the necessity of raising further capital ; and he need not tell the shareholders what would be the cost at which this could be done at the present time. Further, the undertaking of the Company was built up of contracts entered into with various towns for a specified term of years ; and provision must be made, and was being made, by annual contributions to the redemption account, so that, when the contracts were at an end, the shareholders could count on receiving back their investment at about the amount of its normal market value, or what was its normal value some four or five years ago. Bearing these circumstances in mind, the shareholders would, he was sure, agree with him that the

Company were not justified at present in over-spending their actual earnings to any considerable extent. It was true they were carrying forward to next year a balance very nearly equal to that which they brought into the year; but, as he had already mentioned, the Directors had put to the credit of the redemption account £5000 less than last year, and for some years past.

CAPITAL EXPENDITURE.

Turning for a moment to the capital account, it would be seen that more than £24,000 had been spent in the year. This had been divided over the various stations, and had chiefly been incurred at Strandvej and Odense. Extension of mains had cost them about £4000. Beyond this, the Company were already pledged to a further very considerable expenditure of capital amounting altogether to nearly £20,000; and Mr. Edwards, their Engineer and General Manager, urged upon them that the town of Odense (to which, as the shareholders were aware, the neighbouring township of St. Hans had recently been added) needed extensions, which would cost another £30,000. Upon no point in the administration of the undertaking had the Directors laid greater stress than upon the economy of capital, which meant that no more should be spent than the increase in the business justified. But while the expenditure, divided by the output of gas in 1914, represented £764 per million cubic feet, this year it represented £811; and when the extensions in hand, and those to be undertaken at Odense, were finished, it might be materially higher than the latter figure. If, in the meantime, the output of gas increased at its old rate, this would not be the case, because the amount of capital would have to be divided over the larger output. Consequently the rate per unit of output would be diminished. But granted that the Company went on as they had been during the past six or eight months, then the rate would still appear on the accounts as high as £811. He wished the shareholders clearly to understand that there was no reason for apology by either the Directors or the General Manager for any portion of this expenditure. The business of the Company was growing so satisfactorily that the new works and plant were essential; and it was only the abnormal conditions of to-day that made the comparison so regretable. They believed that the war must come to an end some day. But how soon, it was impossible to forecast; and it was therefore necessary that the Directors should take the precautions they were now doing.

RETURNING INCREASES IN GAS CONSUMPTION.

He was glad to say that Mr. Edwards reported that, after very considerable falling away in the months immediately following the outbreak of war, the demand for gas was again rising, and rising satisfactorily. In the month of August this year, the output at Flensburg showed an increase of 5 per cent.—that was, over the fall in the month of August, 1914, of, he thought, about the same amount.

Mr. Edwards: No; between 11 and 12 per cent.

The Chairman remarked that, this being so, while there was an increase of about 5 per cent., the consumption was still considerably behind what it was before the outbreak of war. At Odense, the consumption had increased by 15 per cent.; at Viborg, by 25 per cent.; at Ribnitz, by 29 per cent.; at Strandvej and at Frederiksberg, by 11 per cent. These were, of course, comparing with the falling-off to which he had referred. But it showed at any rate that they were returning to at least normal conditions. With regard to the general accounts, the shareholders would see from the balance-sheet that the insurance account had increased by £1540, and the redemption fund by £18,000. The report explained that, after charging against the profit and loss account balance of £127,953, £10,000 to the redemption account and the debenture interest and loss on exchange, there remained £104,264 available for dividend. If the recommendation of the Directors were now adopted, and the dividends of 2½ per cent. and 5 per cent. were paid, there would remain to be carried forward a balance of £60,764.

PERSONAL MATTERS.

In concluding, he might mention that the Board had been working through a great part of the year without the help of their colleague, Major Bidder, who was with the army in Gallipoli, as an officer in the Royal Engineers. Major Critchley, one of the Auditors, was also absent on service, but had been able to give some attention to the accounts. Bearing in mind the great advantage they had in the services of so competent a second as Mr. Waterhouse, the shareholders could accept the accounts with perfect contentment. In view of the special circumstances of the day, and especially of the projected further expenditure of capital, the Directors had invited Mr. Edwards to travel over from Denmark to consult with them. The Board and the shareholders were very glad he had been able to come; and they bid him a cordial welcome. Few things of a personal character arising from the war had caused him (the Chairman) more regret than that it had rendered it impossible that he should pay his annual visit to the works of the Company this year. He then formally proposed the adoption of the report and accounts.

Lieut.-Col. C. M. Davidson seconded the motion.

Mr. A. Baird thanked Sir Corbet for the very interesting statement he had laid before the shareholders regarding the operations of the Company during the past year. On this occasion, having regard to the war in which this country and the other principal European nations were engaged, he was sure the shareholders all came to the meeting prepared to find that the Company had not escaped from the disastrous effects such a gigantic war was producing all around, and especially in industrial companies such as theirs. Although hitherto the country in which most of their business was conducted had escaped the ravages of the dreadful war, it was inevitable that the financial and the industrial effect of it had led to increased expenditure and diminished income, with the consequent result of reduced net revenue. He was sure he was expressing the opinion of the general body of shareholders when he said that they had every reason to congratulate themselves on the fact that the Directors had so managed the affairs of the Company as to be able to lay before them such a satisfactory balance-sheet, and declare a dividend which was higher than some of them expected. The statement, too, in the report, which had been confirmed in the remarks that the Chairman had made, that during recent months the stations had worked up to about normal output, was, he thought, a very encouraging feature for the future. The difficulties the Directors had had to contend with, in increased cost of freight, coal, and labour, coupled with the loss on exchange, must have been very great; and the best thanks of the shareholders were due to them for the very successful manner in which they had overcome them. Regarding the accounts, he would confine himself merely to saying that he took it that in a Company such as theirs, the increase of capital was inevitable; and the doubling of the sum at the debit of sundry creditors, and the large reduction in the amount in hand in Denmark and London, were no doubt accounted for by the financial difficulties brought about by the war.

The motion was unanimously carried.

The General Manager on the Situation.

Mr. A. W. Edwards (invited by the Chairman to speak) said he was exceedingly glad the Board had given him the opportunity of meeting the shareholders, because he thought it was right the shareholders should know the man in whose hands the Directors had placed the working of the Company's affairs in Denmark. It would be readily understood that, immediately the war broke out, their little country, surrounded by larger nations, was rather frightened for a time. They were not at all sure that Denmark would not be drawn into the war; and on account of this, and on account, too, of the difficulty in which it was seen the Company would be placed with regard to the shipping of coal to Denmark, it was quite natural that they should, in the interests of both the Company and the consumers themselves, try to induce the latter to economize in the quantity of gas they used. They were asked to economize; and he thought this was quite justified, because they did not know to what extent, or how often, they would be able to get any coal over. It was therefore important for the Company that the coal they had in stock should last as long as possible. The Chairman had touched upon the position of affairs in connection with the two works in Germany. With regard to the stations in Denmark, so long as the country was left alone, so long would the Danish Gas Company continue to prosper, as it had done hitherto. Respecting the gas output, recent results were such that, within a very short time, they would regain all they had lost at the beginning of the war. Taking the last quarter and the corresponding ones of 1913 and 1914, it was found that all the works, except Frederiksberg, showed an increase. Flensburg sold in the third quarter of 1913, 44 million cubic feet; 1914, 43 millions; and 1915, 45 millions. At Odense, in the same quarter of 1913, the consumption was 30 million cubic feet; in 1914, 34 millions; and in 1915, 39 millions. At Elsinore, 11 million cubic feet were consumed in the third quarter of 1913; then in the corresponding period of 1914, it dropped to 10 millions; and this year, it had again risen to 11½ millions. At Viborg, in the third quarter of 1913, the consumption was 8 millions; in 1914, it dropped by 200,000 cubic feet; and in 1915, it rose to 9 millions. At Ribnitz, the figures for the three quarters were 1,200,000 cubic feet, 1,300,000 cubic feet, and 1,800,000 cubic feet. The consumption in the town was now jumping up, owing to the high price of coal and petroleum in Germany. At Assens, in the same period of 1913, the consumption was 3,900,000 cubic feet; in 1914, 3,800,000 cubic feet; in 1915, 4,300,000 cubic feet. At Strandvej, in the third quarter of 1913, the consumption was 38 million cubic feet; while it rose to 39 millions in 1914; and to 40 millions in 1915. Frederiksberg, he was sorry to say, had dropped considerably. It fell from 96 millions in the third quarter of 1913 to 85 millions in the same period of 1914; and there had been a further drop to about 80 millions. Of the last-named figure he was not quite certain, as the books were not made up when he left. Therefore on the total, the figures showed that the consumption was creeping up—in some towns it was jumping up—to the position, and exceeding the position, before the war. With regard to their position generally, he thought the shareholders might be satisfied that the Company would be able to work prosperously in the coming years. If Denmark remained free, everything pointed that way.

The Dividend.

Mr. R. S. Gardiner moved the declaration of a final dividend of 2½ per cent. on the preference shares, and of 5 per cent. on the ordinary shares. He remarked that the Chairman had explained very fully and very precisely all the reasons which determined the Board to arrive at the recommendation they now made. Mr. Baird had shown that, on the shareholders' side of the table, all the circumstances were fully borne in mind, and were realized. In the circumstances, he did not think it necessary to say any more in support of the resolution.

Mr. J. H. Birchenough, C.M.G., seconded the motion and it was unanimously adopted.

Re-Elections.

Moved by Mr. F. W. Church, and seconded by Mr. Bernard F. Harris, the Auditors (Major E. A. Critchley, and Mr. N. E. Waterhouse, F.C.A.) were reappointed.

Votes of Thanks.

The Chairman, in moving a vote of thanks to the officers and staff said that, while the Board had had to bear a considerable amount o additional anxiety and worry during the year, he thought it was even less than had fallen upon the chief officers. But their work had been well done. To Mr. Edwards, the time must have been a peculiarl trying one, owing to the uncertainty to which he had referred.

Mr. Gardiner seconded the motion; and it was heartily agreed to

Mr. Edwards having responded,

Mr. F. J. Waring, C.M.G., as a shareholder of upwards of fifty years standing, moved a vote of thanks to the Chairman and Directors fo their excellent services.

Mr. Church seconded the motion; and it was cordially passed.

The Chairman, in responding on behalf of his colleagues and himself, expressed his confidence in the future of the Company. He too the opportunity of explaining that the increased price of gas which th Company were entitled to charge in the various Danish towns was onl operative during a small portion of the year, while the higher price o coal and freight had burdened the greater portion of it. As the would be realizing through the whole period the advantage of the increased price, he himself felt no fear of their falling in the curren year below the level of the past.

CEARÁ GAS COMPANY, LIMITED.

Causes of a Disappointing Report.

The Annual General Meeting of this Company was held last Friday, the London Offices, No. 9, Queen Street Place, E.C.—Mr. F. A. ALLROTH in the chair.

The SECRETARY (Mr. E. Pratt) read the notice convening the meet- and the certificate of the Auditor; and the report [*ante*, p. 220] and counts were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, d the Board were sorry that the results of the year should have ved so unsatisfactory. This result had been caused chiefly by the location of business throughout the State of Ceará brought about the war. At once the cost of coal delivered in Ceará bounded up, ight having increased enormously; and of late the exportation of l from this country had been prohibited, and so the Company had l to depend on America. Further, a licence was now required for export of all kinds of goods that the Company required; and at sent this caused great delay. In some cases, the licence was used, which caused further expense. The Company were seriously onvenienced by the non-payment of the public lighting accounts; this was a financial inconvenience which had occurred before, and ich would have ended as on previous occasions. In addition to ir other troubles, the Federal Government—not the State of Ceará vithdrew the privilege always accorded to them of importing their ods free of customs duties. This was so entirely contrary to the icession, that the Board had been obliged to bring an action against m for restitution of the privilege. The case had been heard, and v awaited only the decision of the Judge in Rio de Janeiro; and as matter was *sub judice*, discussion on the subject was not advisable. ming to the accounts for the past year, he feared it was impossible make a comparison with those of former years. On the one side, vould be seen that the capital was increased by £2176. This was sed by calling up £4 per share on the new shares. Owing to non- ment of the public lighting accounts, the Company were greatly npered. They were much in arrear at the time of meeting last r; but since then, he was sorry to say, they had fallen further iind, though just lately a little improvement had taken place. The te of Ceará would do all they could; but they had had a very ere drought, and were hard put to it to find money to pay their ounts—the public employees even being much in arrears with their aries. Thousands of famishing peasants, with their families, had to be succoured. Funds had been received from the Southern tes to help these unfortunate victims; but, in spite of all efforts, it known that many had perished for lack of food. The Directors that His Excellency Colonel Liberato Barroso, the President of the te, had used every effort to ameliorate the distressing conditions existing in Ceará; and but for his wise and energetic efforts, the sufferings and losses of the inhabitants, and all commercially connected with them, would have been much greater. Owing to the want of the necessary money to pay accounts, the Board were forced to realize the securities the Company possessed; and this they had to do in August and September, 1914. They were trustee investments, but, of course, had depreciated a good deal. Sundry creditors were £5900, against £8791. On the other side, the investment in works and plant was a little less than this time last year, owing to the depreciation written off. Amounts due for gas, meter-rental, &c., were about £2500 more. Owing to the trouble in getting the accounts for public lighting paid, and the difficulty the Company were in on this side in shipping coal, the Directors arranged with the President to light only one-half the lamps. This had gone on since August last year, and accounted for the serious drop in the receipts for gas. Stocks were £1400 less, and bills receivable about £1200 more. In the revenue account, coal carbonized was £2832 less, and generally speaking on the expenditure side there had been a saving in most items. But there was the larger loss of £2579 on exchange, which was beyond the Directors' control. On the other side, the receipts were less by £7700 for gas supplied and £750 for fittings. It had been the aim and object of the Board to keep the works going and in good order; and he was glad to say they were in excellent condition. Their Manager (Mr. Reid) had had a very trying time; and the shareholders were all deeply indebted to him for the energy he had displayed under such depressing conditions. He hoped they had now seen the worst, and that next year the Board might have a more satisfactory report to lay before the shareholders. But it was impossible to prophesy, as so much depended upon the length of the war. Before sitting down, he would like to express the sorrow of the Directors at the death of Mr. Cooper, the Auditor. Mr. F. W. Church had undertaken to audit the accounts for the past year; but he was not eligible for re-election. Mr. W. J. Wright had given notice that he would offer himself for the position.

Mr. F. W. BROTHERS seconded the motion.

Mr. T. A. GUYATT inquired if the dividends on the preference shares were cumulative, as there was nothing on the certificates to show whether or not this was the case.

The CHAIRMAN replied that the first preference shares were cumulative, and the second were not.

Mr. R. M. LONG pointed out that the Directors' fees were paid free of income-tax; and although he had not a word to say against the Directors, he suggested that during these trying times, they should be payable subject to income-tax. In the days of prosperity, the fees formed a very fair percentage on the profits; but now there was a loss, and the accounts were still debited with the fees. He knew the Directors had not taken them; but it was building up a somewhat heavy burden.

Mr. W. RICHARDS said he was interested in another company carrying on operations abroad; and the Chairman had announced that the Directors had decided, without any suggestion from the shareholders,

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to make a substantial reduction in their fees during the continuance of the exceptional conditions. The ordinary shareholders were getting nothing, so the circumstances of the two cases were much the same. Perhaps Mr. Long would be agreeable that the Directors should consider the matter, and deal with it as they might think best.

Mr. LONG remarked that he was quite willing to leave the matter in the hands of the Directors.

The CHAIRMAN promised that the Board would consider the point; and the shareholders could trust them to deal with it.

On the proposition of Mr. BROTHERS, seconded by Mr. T. M'MAKING, Mr. Wallroth was re-elected a Director; and Mr. W. J. Wright was appointed Auditor—moved by Mr. LONG, seconded by Mr. GUYATT.

The CHAIRMAN proposed a hearty vote of thanks to the Engineer and Manager and the staff both in Ceará and London. It had, he said, been a very anxious time; and Mr. Reid had worked very hard indeed for the Company.

Mr. C. WEBB seconded the vote, which was heartily accorded.

The meeting concluded with a similar vote to the Chairman and Directors, moved by Mr. RICHARDS, and seconded by Mr. GUYATT.

TIPTON AND THE CALORIFIC STANDARD.

At a Meeting of the Tipton Urban District Council last Tuesday, the Gas Committee recommended that the agreement with the Rowley Regis and Blackheath Gas Company for the supply of certain works be varied, and that in future the price charged should be 2s. 5d. per 1000 cubic feet. Also that the following new scale of charges be adopted: For lighting purposes, 25,000 cubic feet, 3s. 3d. per 1000 feet; over 25,000 and under 500,000 cubic feet, 3s.; over 500,000 cubic feet, 2s. 6d. For power, up to 100,000 cubic feet, 2s. 6d. per 1000 feet; over 100,000 cubic feet, 2s. 3d.

The Gas Manager (Mr. W. Prince), in his report, stated that the contractors were now making very satisfactory progress with the re-construction of the old carbonizing plant; and though somewhat behind time, he trusted a portion at least would be available for the coming winter demand. He was of opinion that the necessary steps should be taken to adopt a calorific standard for gas, in substitution for the illuminating power test. The tendency all along the line was for this alteration; and among other towns to avail themselves of the advantage was Coventry (for the period of the war). In Canada the test had been adopted in its entirety, in preference to the illuminating power one. They had already installed at their works the necessary testing apparatus for calorific power. The Chairman of the Gas Committee (Mr. W. W. Doughty) said the introduction of the calorific standard as proposed meant that in the future they would manufacture gas with a view to giving more heat; and at the same time it would make no difference to the lighting in incandescent burners.

The reports were approved.

COAL TAR AND ITS PRODUCTS.

In last week's issue [p. 211] there was reproduced from the columns of the "Iron and Coal Trades Review" a letter from a correspondent criticizing some of the statements contained in an article appearing in the pages of our contemporary's previous issue—see *ante*, p. 150. The letter has called forth a reply from Messrs. Hird, Chambers, and Hammond, of Huddersfield, in the following terms.

Sir,—Your correspondent "Distillation" takes exception to the article "Coal Tar and its Products" on the ground that it is "exaggerated and misleading." Perhaps a little explanation will enable him to more fully understand the article to which he refers.

He asks "Is it an everyday condition to obtain 26 gallons of light oils from one ton of tar?" The answer to this question depends entirely upon what is meant by "light oils." In our continuous distillation plant, the light-oil fraction is distilled off at a fairly high temperature. We have about thirty plants in operation, producing in the aggregate more than a million gallons of light oils per annum; and in these plants the average quantity of light oils is 26 gallons of oils per ton of tar distilled. Therefore we maintain that it is an everyday condition to obtain 26 gallons of light oils from one ton of tar by our process.

When your correspondent asks "Can the prices of the various oils as given . . . be obtained at any works at the present time?" we can only reply that the article "Coal Tar and its Products" is not concerned with present-day prices. It is stated definitely in the article that prices are based on market values as they were in 1913. However, as he raises the question of present-day prices, he may be interested to know that a mixture of crude naphtha and light oils (comprising the first two fractions of our continuous plant) is now being sold in considerable quantities at 7d. and 8d. per gallon; and if your correspondent is a practical tar distiller, no one will know better than he that the oils at the present time are well worth the prices named. The quantities of crude benzol and crude toluol referred to are not based on calculated results.

We give a typical distillation test of the total distillate obtained from a London tar, and produced under a working temperature of 400° Fahr.

Specific gravity	·950
100 cc. fractionated gave	5 cc. at 100° C.
	17 cc. at 120° C.

Volume distilled off between 100° and 120° C.
toluol fraction 12 per cent.

Presumably the War Office specification to which your correspondent draws attention refers to pure benzene and pure toluene. These products were not referred to by us. We will, however, state that with efficient plant the War Office specification presents nothing more than the ordinary difficulties. We say this after considerable experience in the production of pure benzol and pure toluol.

Nautilus Showroom Art
will increase your Gas Sales

N.B.—Several important Gas Undertakings have already adopted Nautilus Showroom Schemes.

For Plans, Specifications, and Estimates, apply:—
60, Oxford St., London, W.

With regard to the possibility of rectifying 60,000 gallons of benzols, ain we have to remind "Distillation" of the fact that our costs are sed on 1913 prices; but nevertheless, even with present-day prices, should not hesitate to instal a rectification plant with a firm undering that the total working charges would not exceed £279.

Experiences vary throughout the country as to the percentages of bolic and cresylic acids in tar; and we are quite aware that in some tricts six gallons of tar acids per ton cannot be realized; but we can y repeat that in our own experience, dealing mainly with Midland Southern tars, we have found the figures stated to be quite correct, our average is based upon 30 distinct installations.

Your correspondent finds it difficult to understand why we should e based our article on prices ruling in 1913. But he himself supplies reason for our so doing when he states: "The war has upset prices all tar products." Even to-day's prices are not altogether unfavoury affected—90's toluol is quoted at 2s. 4d. per gallon, crude naphtha per gallon, 60's carbolic 3s. 6d. per gallon, cresylic acid 2s. 6d. per lon.

We cannot agree with "Distillation" when he states that "tar is ficult to sell at anything over 12s. per ton." Very large quantities tar are being sold for 25s. per ton at works. There are cases where ch higher prioes have been realized; and for a good tar at the pret time 37s. per ton is being paid. At 12s. a ton someone is reaping ne harvest, even when pitch is worth only £1 per ton; and when pping conditions become normal again, what will the present stocks pitch realize?

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

t a meeting of the Edinburgh and Leith Corporations' Gas Comsioners held last Monday, Bailie Lindsay reported that the Works nmittee had agreed to recommend that the wages of the blackths at the Granton works be raised to 9½d. per hour. He explained t, in addition, they enjoyed the advantage of three weeks' full pay, three weeks' half-pay when sick, ten days' holidays with full pay, tinuous employment, and the benefit of the superannuation fund, ich the Committee regarded as equivalent to the trade union rate of per hour more. The recommendation was approved. In regard the application from the National Union of Corporation Workers ing an increase of 1d. an hour to all employees at the Granton ks and to the outdoor staff, the Works Committee instructed the gineer (Mr. Alex. Masterton) to procure certain information to be before a further meeting.

peaking in the Edinburgh Town Council in support of the Cleaning Lighting Committee's recommendation that the electric arc lamps the streets should be lighted in the mornings during the winter months, Mr. Bruce Lindsay said the desire for additional lighting in the mornings came in the first instance from those engaged in carting coal from various depôts in the city. But there was a wider question than this. There was a great deal of traffic between 6 and 8 o'clock in the morning; and, as a matter of public safety, it was thought absolutely desirable that these lamps should be lit during this period. There was a scarcity of conveyances just now; and if the hours were shortened, matters would be worse still. They had saved £2318 on the lighting estimate for the quarter ending Aug. 15; and as the increase involved in the proposed morning lighting was £700, it was more than covered by the saving. Some explanation was evidently required about lighting generally. The military authorities had taken charge of the lighting to the extent that, in the event of any instruction from them, in case of alarm being given of a raid, it should be possible to extinguish all the lamps in a quarter-of-an-hour or twenty minutes. Arrangements had been made by the Electricity Department for this being done. As regarded gas-lamps, it was absolutely impossible. Even if the supply of gas was cut-off at the works, the volume in the street-mains would keep the lamps burning for some hours. Lamplighters running round the town could not have the lights out in anything less than two hours. The gas-lamps, therefore, were not lit merely as a matter of military necessity.

The Gas-Furnace Exhibition held by Messrs. John Wright and Co. last week in Glasgow, as already recorded in this column, proved a great success—being very largely attended by manufacturers and foremen and workmen connected with the munition works, who closely examined the special apparatus for shell making, as well as the many standard furnaces for industrial uses which were on view. In addition to the large number of practical demonstrations, there were lectures by Mr. S. N. Brayshaw, of Manchester, on "Some Experiments in Gas Burning," and the "Heat Treatment of Carbon Tool Steel." The exhibition was arranged by Mr. Ralph Halkett, the Commercial Superintendent of the Glasgow Corporation Gas Department, and took place in the department's demonstration room, Milan Street.

In consequence of the reduced lighting of Clydebank after the outbreak of war, the Town Council asked the lamplighters to undertake other work to fill in their standard number of hours. This the men refused to do, and relinquished their jobs. The Fire and Lighting Committee have now engaged six women temporarily to light the lamps, and thus the difficulty has been overcome.

A Report on the Wigan Gas-Works.—When the minutes of the Gas Committee came up for consideration at a meeting of the Wigan County Borough Council, Alderman Angus said the members would notice that Sir Corbet Woodall was at Wigan on Oct. 18, and visited the works. He appeared before the Committee, who asked him several questions, which he answered quite freely, but without prejudice to his report. He also stated that he had been fairly received, and every facility had been given him to carry out his work.

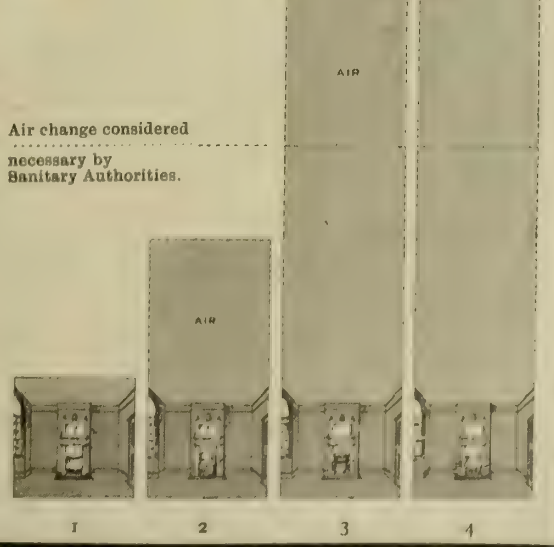
VENTILATION.

Interesting Comparison—the Result of Actual Tests.

The heights of the columns in the accompanying illustration show the comparative volumes of air (in proportion to the size of room) which are carried off by means of the respective heating agencies.

1. Room to be heated.
2. Air-change with ordinary gas fire.
3. Air-Change with "Injector-Ventilating" Gas Fire, with regulator open.
4. Air-change with coal fire—excess tending to draught.

It will be seen how the amount of ventilation provided by the "Injector-Ventilating" Fires is substantially above the figure regarded as a suitable minimum by Sanitary Authorities generally. This figure is indicated by the dotted line crossing the diagram.



NO NEW DESIGNS *are necessitated for embodying this and our other 1915 perfectionments—these are all included in the entire range of our existing standard patterns, from the cheap 10-in. Fire of 25s. List price upwards.*

John Wright & Co. Essex Works, Birmingham.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 1.

There is no change in the situation of tar products, except that dealers are lowering their idea of the value of pitch, possibly as a result of the abnormally high rates of freight now prevailing. Manufacturers, however, do not adopt dealers' views.

The position of sulphate of ammonia is very strong, and prices continue to rise steadily. At the moment the value for prompt delivery is about £14 17s. 6d. per ton, net cash, filled into buyers' bags at makers' works, for 25 per cent. minimum quality, with at least 5s. premium for the spring months.

Tar Products in the Provinces.

Nov. 1.

There is nothing very important to report concerning the markets for tar products. Business in pitch is still very difficult. Creosote remains quiet, and shows no signs of improvement. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 19s. 9d. to 23s. 9d. Pitch, East Coast, 18s. to 19s. per ton; Norfolk, Suffolk, and Humber ports, 18s. to 19s.; West Coast, 17s. to 18s. Manchester; 18s. to 19s. Liverpool; 20s. to 21s. Clyde. Benzol, 90 per cent., North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅞d. to 3d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Oct.* 30.

During the past week the vigour of this market has been well sustained, and a further substantial advance in prices has been recorded. The inquiry from the United States, Spain, and British Possessions has continued good, and a fair volume of business has resulted. To-day's quotations for prompt delivery are £15 7s. 6d. per ton f.o.b. Hull, £15 10s. f o.b. Liverpool, and £15 12s. 6d. f.o.b. Leith. In the forward position, it has transpired that £15 15s. per ton has been paid to producers for January-March, and £15 12s. 6d. for January-June for both Leith and Liverpool shipment.

Nitrate of Soda.

The market for this article is steady on spot at 14s. 4½d. per cwt. for ordinary, and 15s. 4½d. for refined quality.

Sulphate of Ammonia.

From another source it is stated that this article has remained very firm throughout the past week. Outside London, makes are quoted at £14 5s.; Hull, £14 15s. to £14 17s. 6d.; Liverpool, £14 17s. 6d. to £15; Leith, £15; Middlesbrough, £15 15s. to £15 17s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is active, and shipments are heavier, and there is not only a good prompt business, but fuller forward bookings; so that little fuel is free for sale for next month. The steam coal trade is active—more so than for some months. Best Northumbrian steams are steady at 19s. 6d. per ton f.o.b.; and second-class steams are firmer at 17s. 6d. to 18s. per ton, with a keener inquiry. Steam smalls are plentiful, and are quoted from 11s. to 13s. 6d. per ton, according to quality. Production is fairly good, when the depleted number of miners is taken into account. As licences for export have been more freely granted of late, the output is well taken up, though the cost of sea carriage is now very heavy. In the gas coal trade, the tone is firm, and deliveries are full on contracts; so that the sales of occasional cargoes are at steady prices. Best Durham gas coals are now quoted at 20s. per ton f.o.b.; and second-class gas coals are from 16s. 6d. to 17s. 3d. per ton. "Wear Specials" are about 20s. to 21s. per ton f.o.b. Freights are now based on about 10s. for gas coals, Tyne to London; and to the northern ports of France, the sea carriage is also higher than it was. The strong demand for gas coals seems so far to be met; but recruiting is brisk at some of the collieries, and thus future deliveries may not be quite as rapid. Much, however, will depend on the rate of the exports, which seem likely to continue full. The coke market is steady, and the exports of coke now compare favourably with those of a year ago. Gas coke is quoted from 27s. 6d. to 30s. per ton f.o.b, and appears to be in good demand. The production is, however, now increasing steadily, and stocks at some of the inland centres are rather heavier.

◆

After much deliberation, the Hebden Bridge Urban District Council have decided to withdraw all restrictions upon the public street lighting, on the ground that such restriction is mistaken economy. Henceforth the lamps will be lit as before the war.

Careful attention will be given to YOUR enquiries.

R. & J. DEMPSTER, Ltd.,
MANCHESTER.

London Office:
165, GRESHAM HOUSE,
Old Broad St., E.C.

The Boulton and Watt Collection.

The Boulton and Watt collection, which was presented to the City Birmingham by Mr. George Tangye, has been formally opened at Reference Library, by the Lord Mayor (Alderman W. H. Bowater). E. Marston Rudland (the Chairman of the Free Libraries Com- ttee) presided, and pointed out that Mr. Tangye had for many years used the collection at his works, and had always been delighted to w it to anyone who was interested in Watt or Boulton. Mr. Tangye d he secured the collection some years ago, when Boulton and att's works at Soho came under the auctioneer's hammer. Feeling t Watt and Boulton were so closely associated with Birmingham, decided that Birmingham was the right place for the collection to nain in. He might lay claim with pride to some personal connec- n with the firm of Boulton and Watt in the fact that his grand- her took an active share with William Murdoch, more than a ndred years ago, in erecting and putting to work in Cornwall the gest pumping-engine that the firm had made up to that date. There re two Watt collections in existence. At Heathfield Hall, his (the aker's) home, was the workshop of Mr. James Watt, which was v in precisely the same condition as when he died nearly ninety-six rs ago. In it Watt spent most of his spare time pursuing his bies. The present collection related more particularly to business lings of the firm.

◆

Gas Consumption in Manchester.—The gas consumed in Man- ster during the six months to Sept. 30 showed a decline of 3 83 cent. compared with the record for the corresponding six months 1914. The decline is not considered unsatisfactory, in view of the cial circumstances—the reduced lighting in the streets, the earlier ing of public-houses, and the general tendency to economize where- r possible. The day consumption actually exhibits an increase.

Corporation Wages at Bradford.—The gas workers and general ourers employed by the Bradford Corporation are asking for a revi- of their wages. They are receiving at present a war bonus of 3s., or 1s. per week, according to grade; and it has been decided to e application that the war bonus in each grade, together with 1s. week all round, shall be given as a permanent advance in wages. application is said to affect over 2000 men employed in the gas, tricity, and other departments of the Corporation.

Gas Suffocation Cases.—A tragic affair occurred at the Richard den Inn, Chatham, when two daughters of the landlord were as- xiated by an escape of gas from a jet in their bedroom. The light burning when the girls (aged five and eight respectively) went to , but was somehow extinguished during the night and the gas wed to escape into the room. Two elderly inmates of the Bromley on Infirmary have died, also as the result of gas poisoning. They e admitted into the receiving ward late at night. One of the men found dead, the other expired after treatment. A gas-jet in the d was discovered turned on, and all the windows closed.

New Filtration Plant at Monmouth.

New water filtration plant at Monmouth on the De-Clor system, recently erected by the patentees (the Candy Filter Company), has been started and formally handed over to the Monmouth Gas and Water Company, to whom it is giving every satisfaction in its working. On this success, congratulations are extended to Mr. Thomas Brace (the Gas and Water Company's Engineer and Secretary), to Mr. I. Madley Brace (Works Manager), who designed the building and the general arrangement of the plant, and to Mr. A. C. Jarvis (Chief Engineer of the Candy Filter Company). The water is derived from two sources —an upper and a lower spring; and there are two distinct plants, contained in one conveniently arranged house. For purifying the water from the upper spring, the filter is of Candy's pressure mechanical De-Clor type, constructed of steel, and tested to 100 lbs. pressure to the square inch. The main is diverted into the filter-house to a pressure-turbine, which revolves at speeds according to the quantity of water passing, and actuates through gearing two small pumps. The pumps inject into the water minute quantities of two chemical solutions—one sulphate of alumina for the purpose of correcting any discoloration there may be after heavy rain, and the other chlorine to destroy any harmful germs, should they gain access to the supply. The water, after receiving the chemical solutions, flows up to the top of the filter cylinder, inside the upper part of which is arranged a bed of fine silica sand resting upon a perforated floor, through which the water slowly passes. Here the sulphate of alumina, which upon injection immediately precipitates and entangles the particles forming the discolouration of the water, is removed by the sand, and the clear water flows on down the cylinder, taking half-an-hour to do so. This time is allowed in order that the chlorine may perform its function of destroying any harmful germs. At the end of the half-hour period, the water reaches a bed of special material, also resting upon a perforated floor. This material, which is a form of carbon, removes the chlorine, and the water then passes out of the filter. The plant for dealing with the water from the lower spring is similar in principle, except that there is no sulphate of alumina used and no sand bed, as the water is always clear. Further, the water from this spring not being under pressure, the chlorine purification process is carried out by means of Candy's gravity De-Clor type filter. The water receives the chlorine from a regulating device which can be set to suit any required flow, and passing into the filter-tank at one end leaves purified at the other. The capacity of each plant is 250,000 gallons per 24 hours.

◆

Economizing in Public Lighting.—Complaints have been rife among miners and others workers at St. Helens with regard to the street-lamps being extinguished at the time when they are hurrying through the country roads to work. In the Town Council, Mr. Heaton said he hoped the Gas Committee would give the subject careful consideration; and Mr. Plythian remarked that the light had been curtailed as a matter of economy, because of the shortage of labour.

"They Stand Alone in their Excellence."

The beautiful outline and general artistic appearance of Richmond's "Period" Gasfires introduced a note of High Art into the Gas-fire Industry.

The artistic appearance, combined with complete silence in burning and unquestioned efficiency, enable the most exacting requirements to be met.

The "RENAISSANCE."
"Period" Series.

"Design is not the idle offspring of fancy; it is the studied result of accumulative observation and delightful habit."
— *RUSKIN.*

THE RICHMOND
GAS STOVE & METER CO., Ltd.,
WARRINGTON :: and :: LONDON.

Increased Price at Pontardulais.—The Pontardulais Gas Company have given notice of their intention to increase the price of gas from 4s. 3d. to 4s. 9d. per 1000 cubic feet. It has been decided to do away with the public lighting altogether, if the Gas Company persist in this determination.

New Water-Gas Plant for Lancaster. — The Lancaster Town Council, at their meeting last Wednesday, confirmed the minutes of the Gas Committee, and accepted a tender for a water-gas plant to make 500,000 cubic feet per day from Messrs. Humphreys and Glasgow. An offer by Messrs. Gibbons, Limited, to rebuild No. 2 retort-house for £9695 was also accepted. It was mentioned that there would be an application for a loan of £18,000, instead of £17,000.

Newcastle Food Reform Demonstrations.—There were given to good audiences last week, at the Saville Row show-rooms of the Newcastle-on-Tyne and Gateshead Gas Company, a series of food reform lectures and demonstrations; the lecturer being Mr. J. Hough, and the demonstrator Mrs. L. Cohen. Mr. Hough pointed out that the object of the lectures and demonstrations was to show how dishes could be made without meat, and that equally nourishing foods could be prepared, so that people could live at the same cost as they did before the war broke out. He drew attention to the value of cheese, nuts, vegetables, and other products, as food.

Public Lighting in Stoke Newington.—At the last meeting of the Stoke Newington Borough Council, a question arose as to the cost of the public lighting (owing to the darkened streets) and the negotiations with the Gas Light and Coke Company. It was reported that the Company had offered, in addition to the allowance now being made in respect of the lamps not in lighting, to take over for the period of five years from Jan. 1 next the work of repairing and painting lamps and columns now carried out by Messrs. S. Pontifex and Co., under contract with the Council, and to pay for the residue of the term of this contract all moneys which, under it, would otherwise have been payable by the Council to Messrs. Pontifex. It was recommended by the General Purposes Committee that the offer should be accepted; and this was agreed to.

Luton Public Lighting.—Under the contract with the Luton Gas Company, the Corporation pay 1s. 10d. per 1000 cubic feet for the gas supplied to the public lamps during 1915. From March last the Company increased the price to ordinary consumers from 1s. 10d. to 2s. 2d. per 1000 cubic feet; and they consider that the Corporation should pay from that date a price greater than the contract price, especially as they have in the past given the Corporation the benefit of any reduction in price made during a contract period. After giving the matter careful consideration, the Highways and Lighting Committee are of opinion that it is desirable to meet the Company in the matter; and they have therefore recommended the Corporation, having regard to the very exceptional circumstances, to pay 2s. per 1000 cubic feet for all gas supplied to the public lamps from March last to December next, when the contract terminates.

General Gas Company of Magdeburg.—The report of this Company, which owns about thirteen gas-works in different parts of Germany, for the year 1914, states that favourable conditions prevailed until the outbreak of war, whereupon in most places there was a considerable reduction of consumption, and coal was only obtainable with difficulty at increased prices. Supplies of gas from coke-ovens to some of the Company's works were interrupted from September to December, owing to the coke-ovens being all let down. The output of gas during the year showed a diminution of 4·3 per cent. on that for the previous year.

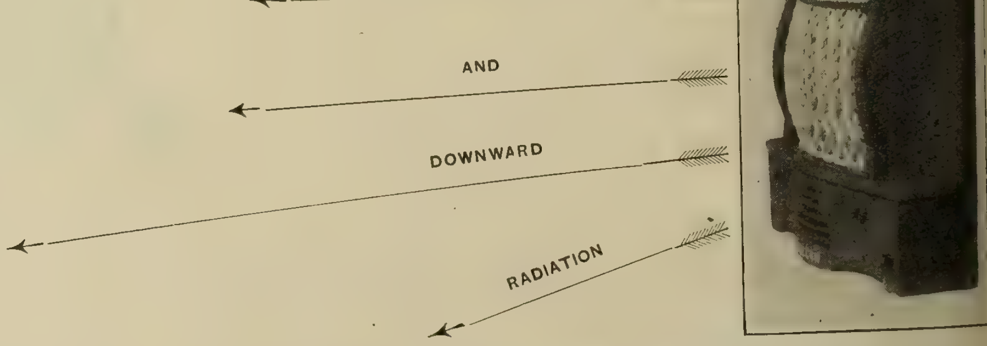
Trim (co. Meath) Gas Managership.—The Trim Urban Council, having considered a report from the Gas Committee showing a heavy loss on the working of the gas undertaking, decided to call for the resignation of the Manager (Mr. T. Connell). The Clerk (Mr. Healy) was asked to take up the duties for awhile; but he said he could not afford the time. The loss in 1913-14 was £102, and in 1014-15 £70. Mr. Connell had reported that the station-meter was not registering accurately; but the Council held that, when charges to consumers were so high, the undertaking should show a profit, or at least there should be no loss.

The British Dye Industry.—The future prospects of the British dye industry formed the subject of an address delivered by Dr. F. Mollwo Perkin, F.I.C., F.C.S., at a meeting last Thursday, in the Bradford Technical College, of the West Riding Section of the Society of Dyers and Colourists. He said that, while one great scheme like British Dyes, Limited, might be valuable, he believed it would be better not to put all their eggs into one basket, but to found a number of smaller factories, which might be established in some of the explosive works when they were no longer required for purposes of destruction. Any such scheme must be organized ahead; and the several factories separately controlled should enter into some form of working agreement, so as not to overlap. Chemists must be trained to carry out research in the manufacture of dyes; and everything should be ready to begin operations as soon as the war might be finished. If possible, a beginning should be made at once.

United Gas-Works Development Company.—The advertisement columns of the Daily Press last week contained an announcement by Mr. William Judd (acting as Liquidator) that a meeting of the creditors of the United Gas-Works Development Company is to be held on the 12th inst., under the clause of the Companies Act relating to voluntary winding-up. The registration of the Company was notified in the "JOURNAL" for Nov. 11, 1913 [p. 540], when it was pointed out that reference had been made in the editorial columns "to a Company similarly styled in connection with the prospectus of the Somerset and Gloucester Gaslight and Coke Company, Limited, whose scheme, it was then stated, had collapsed owing to the intervention of the Bristol Gas Company." It may be added, also, that last week a Company "similarly styled" figured in the Law Courts [*ante*, p. 209], when judgment was entered against them, in default of appearance, on a claim for goods delivered at a gas-works in South Wales.

An Obvious Advance.

A FIRE WITH A CURVED RADIANT.



A Maximum of PURE RADIANT HEAT.

The "LANCET" says "This fire showed no escape or combustion products into the room whatever."

The "LANCET," June 12th, 1915.

MANUFACTURERS:
THE VULCAN STOVE CO., Ltd. **EXETER.**

Loss and Gain.—Four workmen in the gas-fitting department of e Bangor Corporation, it is reported, were refused an increase of ages. As a protest, they went straight to the local recruiting office, id enlisted in the Royal Garrison Artillery.

Brighouse and the Coal Price (Limitation) Act.—The Brighouse as Committee, in response to an offer by the Low Moor Company, at the Company were prepared, provided the Corporation would ithdraw the notice served upon them under section 4 of the Price Coal (Limitation) Act, to make a reduction of 1s. per ton on all eliveries of coal which, according to the dates of delivery in their ntract, would be affected by the Act. The Council resolved: "That) provided the position of the Corporation under the said Act is not ejudiced in the event of there being any further control by Parlia-ent of the coal supplies, and (2) all outstanding deliveries on old ntracts are satisfactorily completed, the terms be accepted, and that e notice be withdrawn accordingly."

Leicester Corporation Gas Undertaking.—The report of the Gas ommittee for the half year ended June 30, presented by Mr. Hilton a special meeting of the Leicester Town Council last Tuesday, owed that the revenue from the sale of gas amounted to £126,963, a crease of £374 as compared with the corresponding period of last ar. The sale of residual products resulted in a decrease of £4291. ie total revenue amounted to £169,075, a decrease of £2472; and e balance carried to the profit and loss account was £47,506, com-red with £43,254. The total expenditure amounted to £121,569, or 5724 less. The balance of net profit was £15,387, an increase of 5977. Mr. Hilton said he was proud to state that 217 men had en-ted; and he asked the public to bear in mind, when any slight in-nvenience occurred, that a heavy burden was laid upon the remaining embers of the staff by the absence of these men.

Nottingham Gas Prices.—In Nottingham newspapers during the st few days, several strongly-worded letters have appeared attempting hold up the Gas Committee to public obloquy for the action which s been taken locally in raising the price of gas. Unnecessary vitu-ration of the Committee appears to have rendered the correspon-nts oblivious of the considerations which have made the increase evitable. The recommendation was that an increase of 12½ per cent. ould be made on the existing prices to all ordinary consumers, cluding consumers for power and gassing purposes. With regard to epayment customers, the proposal was that the price should remain at present, but that the abatement of 1d. in the shilling hitherto ade should be discontinued. Correspondents, in their endeavour cally to stir up dissatisfaction, have been curiously blind to the com-ercial reasons which have alone actuated those responsible for the ntrol of the largest of Nottingham's municipal trading concerns. hey appear to forget that the capital invested in the undertaking, cording to the last published figures, is no less than £1,046,735, and at the Council are now committed to a further heavy expenditure, by e installation of a new Woodall-Duckham plant at Basford.

Spenborough Gas-Works.—A very long discussion took place on the minutes of the Gas Committee at last Tuesday's meeting of the Spenborough Urban District Council, with regard to the condition of affairs at the new gas-works. Several members complained that the position was very unsatisfactory; and eventually it was resolved that a special meeting of the whole Council should be called with a view to the presentation of a report covering present conditions and future prospects.

Street Lighting Charges at Golcar.—At a meeting of the Golcar Urban District Council last week, an intimation was received from the Longwood and Slaithwaite Gas Company, dated Sept. 24, that, in consequence of the high price of coal and other materials, maintenance of street lamps, and the increased cost of labour, the rates of charges for street lighting would be increased by 4s. per lamp per annum from Oct. 1; the increased charges being for twelve months, after which it was hoped that the present abnormal conditions would have passed, and the charges would be reconsidered. The Chairman said the Company were in order in increasing the price under present conditions; but he moved that the Council accept the new price from Nov. 1, instead of Oct. 1, as they had not had an opportunity of considering the matter before. The motion was carried.

Louth Gaslight Company.—At the annual general meeting of the Company, Mr. B. Hall (the Chairman) remarked that, in spite of the critical year through which the country had been passing, the Directors had been able to pay the same dividends as in the previous year, without increasing the cost of gas to the consumer, and also to carry forward a balance as substantial as last year. He hoped the shareholders would approve the policy of keeping a large reserve of coal, which would be facilitated by a purchase of land that had been made for storage purposes. The net profits amounted to £2159, and the balance standing to the credit of the profit and loss account was £3014. This enabled the Company to carry forward £982, and pay dividends at the following rates: Original capital, 15¾ per cent.; improvement stock "A" and "B," 5 per cent.; new ordinary stock (1877), 12¾ per cent.

APPLICATIONS FOR LETTERS PATENT.

14,668.—Price, C. F., "Gaseous furnace." Oct. 18.

14,762.—Driscoll, R., "Incandescent burners." Oct. 19.

14,800.—White, W. W., "Separation of volatile products from solid carbonaceous material." Oct. 19.

14,830.—Crossley, Sir K. I., and Fielden, F., "Producer-gas plants." Oct. 20.

14,836.—Shorey, J. C., "Gas-irons." Oct. 20.

14,903.—Maclachlan, B., "Lighting control." Oct. 21.

14,941.—Pearce, L. H., "Gas-lamps." Oct. 22.

14,970.—Davis, H. N., and Twigg, W. R., "Stoves." Oct. 22.

14,996.—Hall, I., "Gas cookers." Oct. 23.

PARKINSON'S NEW FIRE

THE "WELBECK."

A particularly handsome fire, embodying many special features, fitted with A PERFECTLY SILENT BURNER.

New Fuel Developments.

A SPECIALLY DESIGNED CURVED TOP FUEL holds the upright fuel in position without the aid of the usual guard, and, in combination with the specially designed brick, considerably increases the heating power.

Made in 14-inch and 17-inch Sizes.

The "WELBECK" with Hood.

NEW SEASON'S FIRE BOOKLET NOW READY.

THE PARKINSON STOVE CO., LTD.,
Birmingham, and 129, High Holborn, London, W.C.

The Directors of Meters Limited have declared interim dividends on the preference shares at the rate of 5½ per cent. per annum, and on the ordinary shares at the rate of 4 per cent. per annum.

A defective electric circuit was responsible for a fire which broke out in Old Change, St. Paul's Churchyard, in the early hours of last Friday morning. The flames were extinguished before much damage had been done.

The employees at the Tipton Gas-Works have received an advance of 3s. per week in their wages, in view of the increased cost of living due to war conditions. The "C" process of tar washing for toluol has been adopted at the works.

Wright's "Injector-Ventilating Thermo X" Gas-Grates form the subject of a handsome cloth bound book issued by Messrs. John Wright and Co., of Birmingham. As a frontispiece, there is an illustration in colours, showing the external and internal appearance of a lighted fire, and the method of ventilation. The injector-ventilating system is fully explained by the aid of diagrams; and the noiseless burner is dealt with in the same manner. Following these chapters, particulars are given of the different patterns of gas-grates; these being accompanied by illustrations in which the beautiful designs of the various grates are shown to much advantage by means of the photogravure process.

GAS COMPANIES IN THE STOCK EXCHANGE.

A gratifying feature of business on the Stock Exchange last week was the marked firmness with which the cheerful tone of late prevailing was maintained. Of prime importance among the factors conducive to this was the confidence entertained that, despite the dramatic invasion of Serbia, the ultimate triumph of the Quadruple Entente over the Central Powers is steadily, if slowly, becoming more and more assured. In this connection, the desperate efforts made by Germany to sustain her credit abroad are significant. The magnificent harvest in Canada, and the improving conditions generally obtaining in the Western Hemisphere and elsewhere, are continuing to exercise a beneficent influence. In result, business last week was more active, and several markets showed accrued strength. The War Loan was active and buoyant until checked in a measure by the rise in the rate of Treasury Bills, as to the advisability of which there were differences of opinion. Americans were strong; and in Canadian, the Pacific and Grand Trunk lines had a great rise on fine traffic returns. In the Foreign Market, the buoyancy of Brazilian and Japanese issues continued. South Africans were good on the whole, and several of the Miscellaneous group—notably shipping lines—were in demand. Home Rails, however, still remained in the shade; but the closing prices showed a disposition towards some recovery. With regard to the marking of bargains for cash, the Committee have framed some fresh regulations which will obviate some points of friction, and which will no doubt be generally welcomed. The moot question of a reduction in the minimum prices is not being allowed to go to sleep. Business in the Gas Market showed some revival in point of activity, and a larger number of issues were embraced in the operations. The prices of bargains marked were about on a level with the average of recent weeks, and presented no point calling for special remark. In the Money Market, an abundant supply preserved easy rates for short loans. Discount terms hardened somewhat upon the advance in Treasury Bill rates mentioned above.

Bargains done for cash during the week were as follows: On Monday, British 36, Gas Light ordinary 77, 78¾, ditto debenture 62½, Primitiva 2, ditto preference 3⅛, South Metropolitan 76, 76½, 77. On Tuesday, Commercial 4 per cent. 84, Gas Light ordinary 77¼, 77⅜, 77¾, 77¹³⁄₁₆, ditto maximum 60, 60½, Primitiva 2. On Wednesday, British 35¾, 35⅞, Gas Light ordinary 77½, ditto 10 per cent. bonds 194, 195, Malta 4¹⁄₁₆, 4⅛, Primitiva 1³¹⁄₃₂, 2, ditto preference 3¹⁄₃₂, 3⅛, ditto debenture 70⅛, 70½, South Metropolitan 76½, South Suburban 88, 88½, 89. On Thursday, Gas Light ordinary 77, 77¼, 77½, ditto preference 73, 73½, ditto debenture 62, 62½, 63, South Metropolitan 76¼, 76½, 76¾. On Friday, Gas Light ordinary 77¼, ditto debenture 62¼, Imperial Continental 52, Primitiva preference 3⅛, ditto debenture (1911) 64⅝, 65. On Saturday, British 35½, European £12 15s. 6d., Gas Light ordinary 76½, 76¾, 77, South Metropolitan 76

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

PRICES AND DIVIDENDS AT OUTBREAK OF WAR, WITH LAST DIVIDENDS PAID.

Issue.	Share.	When ex-Dividend.	Previous Div. or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.
£			p.c.				£ s. d.
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2
374,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5⅞—6⅜	5 17 8
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c. . .	29—30	5 6 8
373,480	10	"	7	7/-	B 7 p.c. .	15—15½	4 10 4
95,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9
—	—	—	—	4	Deb. . .	..	—
380,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3
330,000	"	"	†11	55/-	Do. New . . .	204—209	5 5 3
50,000	"	"	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1
206,250	"	June 11	4	4	Do. 4 p.c. Deb. .	91—93	4 6 0
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 8 4
244,200	"	"	8	7¾	Do. A Ord. Stk. .	154—159	5 0 8
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—
100,000	10	—	—	4/6	Do. 4½ p.c. Pref. .	4—6	—
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	4 10 11
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2
560,000	"	"	5⅓	46/8	Do. 3½ p.c. do. .	103—105	5 1 6
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11
800 000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3
200 000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8
—	—	—	—	11½	Croydon B and C 7 p.c.	..	—
492,270	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0
55,000	"	—	4	4	Do. Deb. Stk. .	102—104	3 16 11
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1
16,362,910	Stk.	Feb. 12	4/17/4	4 4/-	Gas Light and Coke 4 p.c. Ord. . .	98—102	4 15 6
2,600,000	"	"	3½	3½	3½ p.c. max. .	76—79	4 8 7
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6
130,000	"	"	10	10	10 p.c. Bonds .	..	—
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼—16¾	6 11 4
—	—	—	—	9½	Hornsey 7 p.c. . . .	..	—
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C . . .	151—154	5 2 4
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0
65,500	"	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	5 12 6
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11
718,100	"	"	7		B	146—14	4 14 7
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—

Issue	Share.	When ex-Dividend.	Previous Div. or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.
£			p.c.				£ s. d.
75,000	5	June 11	6	4/-	Malta & Mediterranean	4⅛—4⅝	6 9 9
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	6 13 4
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10
55,940	10	Feb. 26	7/14/	7/8½	North Middlesex 7 p.c.	14—15	5 2 8
300,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7¼—7¾	6 9 0
60,000	50	Feb. 26	13	65/-	Portsea, Island B . .	128—131	4 19 8
100,000	50	"	12	60/-	Do. C . .	118—121	4 19 2
52,000	50	"	10	—	Do. D . .	..	—
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	6 13 4
499,960	5	June 26	5	2/6	" 5 p.c. Pref. .	4¾—5	5 0 0
521,600	100	June 2	4	4	" 4 p.c. Deb. .	91—93	4 6 0
—	—	—	—	4	" " " 1911	..	—
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8
209,984	"	"	10	10	Do. B	222—224	4 9 8
523,500	"	"	10	10	Do. C	220—222	4 10 1
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5
60,000	"	"	5	5	Do. 5 p.c. Pref. .	110—112	4 9 8
—	—	—	—	48/4	Do. West Kent. .	..	—
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9
629,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c. .	135—138	5 8 8
742,275	"	"	6	6	B 3½ p.c. .	115—117	5 2 7
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 8
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4
					Wandsworth, Wimbledon, and Epsom—		
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7
108,075	"	"	5/17/3	57/1½	" C 3½ p.c.	110—115	5 2 0
352,000	"	"	6⅛	57/6	Wimbledon 5 p.c. .	117—122	5 0 5
98,000	"	"	6⅝	63/9	Epsom 5 p.c. . . .	121—126	5 5 2
88,416	"	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11

*** For List of Lowest and Highest Prices of Bargains, see second paragraph of article above table.

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Manager (Barbados). Applications to 21, John Street, Adelphi, W.C., by Nov. 10.

Assistant-Manager. Colne Gas Department. Applications by Nov. 5.

Assistant (Montevideo Gas Company). Applications by Nov. 13.

General Foreman. Crowborough Gas-Works.

Foreman (Benzol Plant). No. 6114.

Fitter. No. 6109.

Plant, &c., Wanted.

Tank-Waggons. No. 6113.

Sales of Stocks and Shares.

Grays and Tilbury Gas Company. Tenders by Nov. 4.

TENDERS FOR

Coal.

Liverpool Gas Company. Tenders by Nov. 17.

General Stores (Oils and Drysaltery, Ironmongery, Iron and Steel, Glass).

Stoke-on-Trent Gas Department. Tenders by Nov. 10.

Lamp Columns.

Stoke-on-Trent Gas Department. Tenders by Nov. 10.

Pipes, Fittings, &c.

Stoke-on-Trent Gas Department. Tenders by Nov. 10.

JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXXXII., No. 2739.] TUESDAY, NOVEMBER 9, 1915. [67TH YEAR.

EDITORIAL NOTES.

Toluol and Statutory Obligations—The Case of the Small Works.

DICATION was given in our editorial columns last week it affairs were developing in connection with the process the recovery of toluol by gas-washing; and it may now taken for granted that the further step has been definitely cided upon with the view of increasing the supply. Asso- ted with this is the important question as to the position gas undertakings which, by reason of compliance with the quirements, may infringe their statutory obligations. There satisfactory answer. Any undertaking the gas supply of ich is reduced below standard quality owing to the work t it is doing for the Ministry of Munitions will not incur penalty through failure to comply with the statutory scriptions; these being over-ridden by the Defence of Realm Act. Beyond this it may be stated that every- ng is being done, and will we understand be done, to de- d gas undertakings from any attempts that may be made disparage them and their supply through consequences sing from what they are doing for the Government, and, ough the Government, for the country. This intimation l allay any uneasiness on that score.

)ne result of the articles that have recently appeared our columns on the subject of working for the maximum sible supply of toluol, has been certain communications n small undertakings. Among them is one which puts is a number of questions bearing upon the matter. It st be confessed that we were somewhat astonished to eive the inquiries; and, although in last week's issue it intimated that there was no occasion to make public erence to them, perhaps after all an answer will be of e than individual service. The writer—and he a gas ineer—sought, in the first place, information as to the of small works that could reasonably be expected to put "C" process into operation. There is not the slightest essity to define the minimum size of works that can pt the process. It is not the size that is important, the conditions. In this terrible war, great and united rt has to be made, and heavy sacrifices incurred. But not, in this particular matter, a heavy sacrifice that is ig sought from either large or small gas-works. And the y that best fits the foregoing question is that a man in rge, or having control, of a gas-works who says it is too ll to help in the supply of toluol should be placed in the e category as the military fit man who offers the excuse he will not, or that there is no occasion for him to, join Army because he is only one man out of 3 millions. Army of which the nation is so proud is made up of viduals; the total quantity of coal the gas industry car- izes is made up of tons, hundredweights, or pounds; the l amount of toluol required in this war is made up of ons. The contribution of any gas-works will raise the e of the total. Every gallon brought into the common k, every shell that can be produced as the result, every e and every bomb that is charged, make the country's tion the stronger and the more secure. In this matter ing is negligible.

nother question put to us by the correspondent is as to cost of the plant necessary to work the "C" process. cost of the plant naturally depends upon the quantity vork to be done; and no gas engineer would find it essary to ask this question if he had made himself uainted with the process, as could have been done by the y of the circulars sent to every gas undertaking in May by the High Explosives Department. With before the information contained in these circulars, any gas neer could estimate for himself the cost. But the very ose of the "C" process was to provide a method of ing gas that would only require the simplest of plant, and plant that is already available on most gas-works. A good deal of ingenuity has been shown in connection with the provision of plant for the process; even discarded plant has been reintroduced to carry it out. Some of the small works that are now doing their best had not the necessary spare plant, or had only part. The deficiency in some cases may have been a pump or a scrubber. And it has been gratifying to witness how, without any ado, and without reference to anybody, the deficiency has in most cases been made good, as plant of the kind will come in useful in normal times as expansion or replacement necessitates. Of course, in the smallest of works which have not the requisite spare plant, and from which, if the process were adopted, only a comparatively small increase of toluol per annum would be obtained, it might not be worth while buying new plant. But, speaking generally of works, in not a few instances, the extra return received from tar as a result of its enrichment through the process has compensated for the initial cost. The managements of gas-works who send their crude treated tar to the tar distillers should see that they get the increased value for it. The Government have a fixed price which they pay for toluol; but we are sorry to say our information goes to show that not all tar distillers are "playing the "game" in their dealings in this particular respect with gas undertakings.

The next question with which we have to deal seems to contain a veiled suggestion that the High Explosives Department favour some gas-works, and not others, in the way of initial assistance. Knowing what we do, we are rather sorry to see this. The question was, "Does the Government supply the plant, or is it left to the patriotic tendency of some; while some favoured works receive Government assistance?" Most gas undertakings, if they have not the plant at liberty for the process, have made no bother about the matter. The call came; the ability to respond was there; and there was hearty response. In only a comparatively few cases has any financial assistance been rendered. And in them a grant has only been made after complete satisfaction that the claim is a reasonable one. But let us put the matter into figures. There are to-day some 600 gas-works with the washing process already at work; there will be more shortly, but the number falls very far below the total gas-works in existence in the United Kingdom. Of the 600, not more than twenty have asked for financial assistance. This speaks well for the simplicity of the process; it speaks loudly too of the patriotic feeling that has prompted ready compliance. We would rather be one of the 580, than one of the twenty. Every one of the twenty cases has had to be considered on its merits; and not all of the applicants for a grant have been successful. The sole factor, we believe, that has guided the department has been the increased amount of toluol that is likely to be obtained for the money spent, because naturally there is a limit to the price that even the country can afford to pay for toluol. Where assistance has been rendered, it has only been a percentage of the total outlay. These facts will show that any insinuation as to favouritism in financial aid may be dismissed as having no foundation. It is a matter of extreme gratification to know that such a small number of the gas undertakings with the process in operation have even sought financial help.

There were two other questions put by our correspondent. The first one is answered in the important announcement made in the opening paragraph of this article. The other one was, Where can particulars of the "C" process be obtained? Are we to understand by the inquiry that this gas engineer has not seen the circulars sent to gas-works in May last? Are we to understand that he has never been to any one of the several private meetings of gas engineers at which the "C" process has been discussed? Are we to understand too that the gas-works in which he is interested have never been visited by an Inspector—one of the several gas engineers who are voluntarily and patriotically devoting time to this work? We really cannot bring ourselves seriously to believe that any gas engineer in this country has not heard of the "C" process, and does not know its details. A paragraph was read the other day in which it was stated that a man had been discovered in a very rural quarter of the country who had not heard that so great a part of the world was engaged in war. But we had no notion a British gas engineer could be discovered who to-day did not know the details of the "C" process. There is no intention of enlightening him here; but there is not the slightest doubt that the High Explosives Department would be pleased to take the case in hand, and supply the knowledge which was in the possession of other gas engineers six months ago.

We reiterate what has been said in a previous article, that those who have the power to help in any way and in any degree to produce victory, and do not perform their part to the full are enemies to their country. Victory is the first interest to-day of every true patriot.

A Chemical Intelligence Department.

The Board of Trade will be glad when peace again reigns, and when the men who have schemes for raising the prosperity of the country to a high altitude have subsided to their former state—at any rate, this is so of those whose schemes bear facial evidence that their authors' ideas and ideals have not about them an essentially sound practicability. Since the war began, the Board of Trade have been proposed as the dumping-ground of all sorts of measures associated with the expansion of industry and trade, and the bagging of the commerce of the enemy; and, despite the past reputation of this much overloaded Government Department, another project has been propounded for its acceptance. This has emanated from the brain of Dr. M. O. Forster; and he first put it forward at the annual meeting of the Society of Chemical Industry, and last week introduced it for the consideration of the London Section of the Society, on which occasion there was a very manifest division of opinion upon it, though courtesy allowed no actual hostility. What he wishes is that a Chemical Intelligence Branch of the Board of Trade should be established. An "intelligence" branch associated with anything is about the last class of work that, in addition to what they have already in hand, the Board should be asked to take up; for it is common experience that the functions of the Department in this regard are generally so exercised, that there is a remoteness between the data and the time of availability through which a large part of their usefulness is lost.

There is by no means opposition on our part to the organization of any system which will assist any industry by the collection, co-ordination, and circulation of information. But the whole success of such a scheme depends on the rapidity with which the work is achieved, and reliable results are placed at disposal. It seems to us that the chemical industry is wealthy enough to have an organization of its own, with commercial agencies in all parts of the world, to supply it with information, and that this could be done with greater genuine result, and better control, than if the matter was placed in charge of the Board of Trade, and the data subjected to the ordinary routine, and secreted away till such time as red-tape permitted their disclosure. But it appears that Dr. Forster thinks that neither the general public nor the Government fully appreciates the chemical industry, nor does enough for it; and this fact has put it at a disadvantage when compared with Germany. The chemical industry of this country is actually one of the wealthiest of all the industries; and it ought to have been quite capable of looking after its own interests, and not have allowed things to come to the pass portrayed. Unless some definite steps were taken, Dr. Forster said, to establish chemistry on such a footing that it could assume its proper place in the national economy, the restoration of European peace would be a signal for the restoration of British chemistry to its former ignominy. Whose fault is it that British chemistry has not hitherto assumed its proper place in the national economy, and whose fault will it be if after the war it sinks back into a secondary position compared with Germany? We are all prone to look after ourselves; that is only human nature, though some are disposed to do so to a point that falls within the region of a slavish selfishness. Those of the chemical industry who think the Board of Trade should take the industry under its wing, and act as intelligence collectors and circulators for its benefit as much as for that of the "national economy," should explain why such preferential consideration should be showered on it, and not on other industries that are equally worthy, if not so opulent.

The scheme of work that Dr. Forster suggests should be taken in hand by the Board is of an extensive character, as will be seen by the report in another column. Some of the officials of the Board of Trade have no doubt been interested in it, have smiled over it, and have consigned it to a place where it will no further trouble their minds. The machinery that would be wanted to give effect to the scheme as roughly drafted would be of a remarkably complex character; and complex machinery frequently gets out of order, and does not run with the perpetual smoothness that is desirable. Consideration of this in relation to Dr. Forster's estimate of the cost shows how he fails in practicability—for his estimate of annual expense is out of all proportion to the vastness of the work that he would like to be undertaken. His computed £5000 would soon be expended. But if this were all the expense required for such a great work, then the chemical industry ought to be ashamed of itself for not undertaking it on its own account—organizing it properly, and reaping the benefits at as early a date as possible. Dr. Forster, if he wants to see his scheme develop, had better turn his eyes away from Whitehall to the direction in which chief interest in the matter lies.

Government Reciprocity.

The Government have in connection with the war established several new departments and appointed various Committees to look after special work. With the mass of work entailed by the great upheaval, devolution was unavoidable. But now the Government ought to appoint another Committee charged with the duty of seeing that what is done by one department is not detrimental to, but if anything facilitates, the work of the others. The conditions now existing between the Government and the gas industry are absurdly antagonistic. The Government ask much of the industry; but they will not give it the wherewithal to increase its capacity for meeting their requirements, nor do they set a good example. The gas industry, in one sense, is worse of than the children of Israel when they were given no straw with which to make bricks, for they were allowed to g and gather straw on their own account, although they ha to produce the same tale of bricks. The industry is no even permitted to gather for itself what is requisite (an yet the Government will not supply it) to do the bes possible to meet the country's needs. This was pointedl shown by the letter from Mr. W. M. Mason in last week' "Journal," giving an account of the case that was laid (i was tantamount to a protest) by the deputation before Si Sothern Holland, who represented Lord Moulton, at th Ministry of Munitions. The deputation was composed o Mr. John Young, President of the Institution of Gas Eng neers, and Mr. W. E. Price, Hon. Secretary; Alderman Templer Depree, Chairman of the Council of the Society o British Gas Industries, and Mr. F. W. Goodenough, Chai man of the Executive Committee of the British Commerci Gas Association. Alderman Depree, by the way, at th meeting of the Society of British Gas Industries, referre to the matter, and expressed the hope that the anomalou conditions would not be allowed to rest without still furth effort to get them into something like order, so as to ma them helpful the one to the other, instead of their bei continuously hostile.

The Government say: "This is a war of high explosive "and the gas industry must give us more and more of t "essentials with which to make them." A Committee a pointed by the Government urge the public to consume mo gas and coke instead of coal, in order to increase the supp of gas from which toluol and other valuable constituents c be extracted. But the departments that are asking for mo explosives, and the one that urges the public to use more ga find that their efforts in this direction are rendered part ineffective by other departments withholding sanctions capital-raising and loans for the extensions of gas plant a the provision of appliances through which gas is consum Increases of consumption cannot be met if there is not t extra producing and distributing plant available; and co sumption cannot be enlarged without there are the applian to be let out on hire to the public. Other conditions that a difficult to reconcile are that the War Savings Committ urge people to use gas and coke, in order to save coal, a ielp to provide more gas which can be washed for the recovery of the valuable constituents for war purposes, while he Government do not set them the example. There are iumerous Government buildings in which gas instead of oal could be used for heating and coke for hot water supply; nd, in connection with many of the new premises connected vith the training of the Army, there is larger scope for the mployment of gas than is now the case. Custom and elec- rical influence in certain Government departments are pro- ably responsible for this last-mentioned state of things.

But there is the absurdity of the contrary conditions—the sking for more explosives, and urging people to use addi- onal gas, while capital is being withheld from the industry nd the Government themselves, in the public buildings, re not practising as largely as possible what one of their ommittees have been preaching. There must be econ- my in labour in order to raise the producing efficiency of the ountry, and in order to release as many men as possible or the Army and Navy and munitions work, and women or such work as comes within the limits of their capacity. he use of gas in the industries producing munitions has wered the requirement for labour in proportion to output, nd the extension of gas for domestic purposes has dimi- shed labour in the home—thus increasing the country's ailable labour. With all this, facility and encouragement r the industry are denied by the existence of opposing con- tions, by jealousy of departments, and by unwillingness make exceptions to rules when exceptions are palpably stified. Distribution of work may be most essential in the overnment departments; but so is system over all of them, the utmost good is to ensue for the purpose upon which al and desire are bent throughout the nation. System and -ordination cannot be realized while things are as now.

Scientific and Industrial Research.

our "Correspondence" columns, there appears a letter om Professor W. A. Bone, F.R.S., treating of the proposal establish a permanent State-aided organization for the omotion of scientific research, with a view to its appli- tion to trade or industry. In this communication, the iter appears in the dual *rôle* of friendly critic and adviser. o one can challenge his competence to adopt this dual *rôle*, view of his personal work as a scientist and investigator, d his experience in developing invention with the object its application to industry. The State aided scheme has s blessing; but the advice which he tenders in his letter y be taken as a warning that, if the scheme is not organ- d and developed on lines which will promote the most icient results, and give encouragement and protection to e country and to individuals, it will fall short in it poten- lity for good, and may inure to the material advantage of eign countries, and, to the extent that it does so, to the triment of our own in limiting the financial benefits that should realize from its own brains and enterprise. This s to be guarded against. The letter gives us what Pro- ssor Bone conceives to be the correct lines upon which e scheme should be organized. There are various points and touching upon, the communication to which we will e another opportunity of drawing attention, and which have not the opportunity of dealing with on the present casion. The subject is one of such importance to the ure well-being and development of British industries that should receive the careful consideration of every person o takes an intelligent interest in the progress of home osperity. We are incurring an indebtedness to-day which kes the highest possible promotion of the national pros- ity an essential matter; and the efficiency of any scheme his end will depend upon the manner of its establishment, the lines upon which it is conducted and worked. This ng so, considered views such as those that Professor Bone ances should be very valuable, and help those chiefly cerned in the matter to propound the details of a scheme rthy of the country and of the beneficial object.

tensive Cultivation—National and Agricultural.

ERE has been a perfect deluge of oratory and writing what must be done to make the most of our position ionally during and after the war. We are building-up ourselves as a nation a tremendous load of debt on ount of the work now in hand; and we have not only to pare for the liquidation of this debt, but to secure and elop our industrial and commercial position. Intensive cultivation is a short expression for the application of scientific methods to agriculture with the view of increasing the yield of the land. It is a convenient expression in connection with the subject in hand. The road to making this nation more prosperous, and so enable it to the more readily liquidate the heavy load of accumulating debt, and to consolidate the country's industrial and commercial position, it is generally conceded is by intensive cultivation—in other words, by bringing about a closer union in all industries between scientific and theoretical learning and practical experience. Dr. J. A. Fleming has, in a lecture at University College, been dilating on the (especially lately) well-advocated method. He has pointed out that there are no short cuts to national efficiency or to scientific pre-eminence; but it should be the concern of all to bring scientific methods to bear upon the affairs of the nation. But though we are all persuaded that the truth of this matter is as firmly established as any scientific truth, yet we pursue the old custom of not going seriously and expeditiously to work in order to produce reformation. This is not what is now required. Procrastination will serve the enemy better than it will us nationally. So Dr. Fleming urges that proper steps should be taken to thoroughly organize scientific and inventive ability, and bring about its better application in industrial work. But this will never be thoroughly, but only sporadically, done, unless the industries of the country are themselves first organized with the specific view of bringing about this closer union and aid.

There must, however, be great care in the selection of suitable aid in working with the view of realizing the intensive cultivation of national prosperity. For instance, it would hardly do for the home gas industry or the coke-oven industry, or for the matter of that the nation itself, to seek Dr. Fleming's aid in advancing their interests in the artificial fertilizer field. In the course of his lecture, he remarked:

> Another question is the use of coal as a means of producing the electric energy necessary to oxidize atmospheric nitrogen, and so produce fertilizing compounds. We have to adopt more largely intensive cultivation of the soil for food production, and we must produce the nitrates and ammonia salts necessary for fertilizers out of our own atmosphere and water, and by aid of our own coal, and not purchase them from outside, or let other nations make them for us.

We have recently been counselled by another eminent Professor not to waste coal in industry, but to make the most out of it in order to advance the economic interests of the nation. The burning of coal under steam-boilers only to produce electric energy is a process wasteful of many valuable constituents—among them the nitrogen from which sulphate of ammonia (the best of all artificial fertilizers) is made. Dr. Fleming, it appears, would continue to permit this waste, in order to obtain electric energy with which to oxidize atmospheric nitrogen, while he might go to work in a more scientific way, by carbonizing the coal, so producing gas for the generation of the electric energy, and at the same time rescue the other valuable ingredients of the coal. He writes as though our artificial fertilizers are all purchased from abroad. This is unkind. From 16 million tons of coal used in the gas industry, from an almost equal tonnage of coal used in the bye-product coking industry and in producer gas plants, not omitting the yield of the shale-oil industry, there is an output of sulphate of ammonia which so far exceeds the demands of this country that many, many thousands of tons have to cross the seas to find absorption in other markets. Perhaps we have not correctly interpreted the remarks of Dr. Fleming as quoted above. If so, then ambiguity of his own making must be responsible for our want of appreciation of his intentions.

Architects and the Service of Gas.

A LARGE amount of valuable work has been done among the medical profession in connection with the uses of gas; until now probably four-fifths of the faculty in London employ gas-fires in their own houses for heating, to say nothing of the other purposes to which gas is applied by practically every one of the members of the profession. They were not altogether blameworthy for their past attitude towards gas heating; the primitive types of gas-fires were enough, with their desiccating effect upon the atmosphere, their emanations of products of combustion, and their low radiant efficiency, to make an enemy of every medical man. But that is now completely and permanently changed; and there are, and have been for some time, thousands of medical converts to gas heating. Architects, too, are to-day much more friendly than they formerly were; and the conventional provision for coal-grates and coal-heated kitcheners and water-circulating boilers has undergone considerable change. The gas-stove maker is now frequently in collaboration with the architect, who must to-day, to meet the views and wishes of his clients, be as well acquainted with the gas-stove makers' show-rooms and goods as he is with those of firms who specialize in coal ranges and grates. But there is still much work to be done among architects—work of a technical and generally informative character. It is a sign of growing interest and recognition when one sees that the architectural and building journals are devoting space to treating of the place gas occupies in the modern household conveniences, and advocating the modifying of architectural features and plans, so that rooms are arranged for gas heating, with flues of the restricted area that is sufficient for the products of combustion and for ventilating purposes, and so saving space and expense in this way, as well as by not having to provide coal-grates. Architects, too, are not so indifferent as they were at one time respecting the provision of accommodation for gas-heated ranges in kitchens, as well as for gas or coke heated boilers. Architectural progress includes consideration for the advances in domestic convenience, comfort, and labour-saving; and no architect can to-day afford to be behind the times in these matters.

Our attention has been again directed to this matter by references in the annual reports of the British Commercial Gas Association and the American Gas Institute. In the report of the former, it is stated that a book is in preparation, on the uses of gas, for the information of consumers, and especially of architects. This appears to us to be a peculiar combination. It seems hardly possible that a book which appeals to ordinary consumers will be exactly the sort of thing that will be most useful to architects. A book prepared for the former would hardly go far enough for the latter; and what would be requisite for the latter would naturally deal with important technical details which would repel rather than draw the ordinary consumer. We hope the value of the Association's book is not going to be spoilt for both the ordinary consumer and the architect by trying to make it fit distinctive purposes. It seems to us that the preparation of a book suitable for the architectural profession should be a matter for the Institution of Gas Engineers. The American Gas Institute thinks that it is their business; and, from their last report, it was seen that their scheme for a volume for the information and guidance of architects and builders is of very comprehensive character. If the plan is consummated, the Committee who have the matter in hand will produce something that will be really worth having by architects, as well as of value to the gas industry.

It is contemplated that information shall be given in it as to the supply, standard, and character of gas service, including information as to qualities and necessary quantities. Then piping, specifications, &c., will be treated upon. Following, the uses of gas in the home and for industry will be explained in good detail; and then there will be description of appliances to be used for lighting, heating, and power. The advantages of gas as the agent for these purposes will be put forward—economy, flexibility, artistic considerations, reliability. Then there is to be guidance as to the size of units essential under certain representative conditions. Hygienic value, quality of light, effect of lighting agents upon the eyesight, the safety of gas, the aid that it is to ventilation, and the effect of the use of gas upon the chemical constitution of the atmosphere are to have place in the composition. There is also to be all sorts of information as to the use of gas as a fuel for domestic and industrial purposes, including power. Any book that falls short of this plan will be lacking in information that should be put into the hands of the architect. If it was not contemplated that the book the British Commercial Association have in hand should come up to the American project, then it would be a good thing for revision to take place, so as to co-equal the information, if not to carry it somewhat further. Of course, the synopsis of the contents of the American book does not indicate the details; but the usefulness of gas in assisting in the reformation of certain architectural details is also a matter that should be embraced.

It is a coincidence that the two reports referred to should have simultaneously drawn attention to the question of providing information for architects in connection with gas utilization; but the fact shows that on both sides of the Atlantic the matter is regarded as highly important, and as calling for consideration and action. It is so important that we hope it will receive adequate and thorough treatment. Work of the kind that is worth doing at all is worth doing well.

Trade Marks and the Enemy.

Before the Society of British Gas Industries, last Thursday Mr. R. J. Milbourne brought the subject of "War and British Trade;" and one outcome of this was that much was heard as to the underhanded methods of German traders, behind which methods they laugh at the rules and regulations of British authority, and quietly pocket the proceeds of their craftiness. There was ample evidence forthcoming that goods made in Germany, or in neutral countries with German capital, reach this country with fictitious trade marks upon them, or otherwise labelled with falsehood as to the land of their birth. There was passed round the room a box of mantles labelled "British made." The label covered one bearing the name of a firm and an address in Berlin. This flouting of British authority is proceeding under the very noses of those who ought to detect this commercial *ruse de guerre*; it is going on while the country is at war, and when the country and its manufacturers ought to be protected from the trading wiles of the enemy in a more effective way. If this sort of thing can now exist, one cannot look very hopefully on the position when what Mr. Milbourne referred to as that great economic struggle is upon us that is going to take place after the war. In the comparatively simple matter of trade marks, the Government ought to see that the home buyer and manufacturer are defended against counterfeit and public deceiving presentments of the genuine thing. But they do not appear to be prepared or very anxious to take up the matter. Through the Board of Trade, the movement of some short time since for an Empire trade mark for the protection of this country and our Colonies ended abortively. There seem to be a good many flaws in connection with this particular matter, and there is no sign of any attempt at rectification. It was suggested at the meeting that there ought to be a full investigation into the use of fictitious trade marks and pseudo-descriptions. That is so; but British manufacturers must combine to bring their full weight to bear upon the Board of Trade, or, following precedent, nothing will be done.

Gas Undertakings and Foreign Made Goods.

Of course, as was pointed out by one speaker at the meeting, it will rest very much with the buyers whether, after the war, they will assist the manufacturers at home, or those of Germany to re-establish their commercial opulence here. There are gas undertakings to-day that are patronizing the enemy under spurious designations and stampings; but there are also gas undertakings that will have nothing to do with any articles the origin of which is suspect. There are patriotic, as well as unpatriotic gas undertakings. They cannot all be placed in the same category. Members of the Society, however, see in show-rooms of certain gas undertakings, lamps, mantles, and glassware that they know are not "British made"—lamps that bear all the evidence of their Teutonic origin, and mantles that they know have travelled *viâ* a neutral country before being landed on British soil. The glassware we are not so surprised at, owing to the incompetence of this country to cope at present with the full demand, and the fact that some of the American production that has been tried is not all that is desirable, especially in the matter of heat resistance. In a time of famine, one does not feel disposed to turn from the door the very thing for which there is dire need. Anyway, the members of the Society of British Gas Industries do not regard the purchase to-day by gas undertakings of goods bearing evidence of German origin as either creditable or patriotic.

Protection Wanted.

There is another point, and not a very pleasant one; but there must be allusion to it. A majority of the members of the Society contribute to the funds of the British Commercial Gas Association; and they are urged to contribute more. The object of the Association is the expansion and consolidation of the British gas industry generally, which does not include the expansion, now or hereafter, of the trading enterprise of enemy

ountries. It is stated that it is known that even some of those
epresenting gas undertakings subscribing to the British Com-
ercial Association have been—some are still so—purchasers of
oreign-made goods of types which, of equal quality, but perhaps
moderately higher prices, are produced in this country. This
not encouraging to certain of the manufacturers contributing
the Association; and they will next have to subscribe among
emselves towards a fund for carrying on a campaign among
us undertakings that are not all-British in their dealings. At
e meeting last Thursday, Mr. Fred. J. West drew attention to
resolution passed by the Manchester City Council to the effect
at no contract shall be entered into with any person of German
Austrian nationality, and that no contract shall be entered into
th any firm or company whose subscribed capital (whether by
ay of shares or otherwise) is held or controlled to the extent of
e-third or upwards by persons of German or Austrian nation-
ty. This is a sweeping resolution; but the Manchester Cor-
ration are by it setting an excellent example to the citizens.
connection with gas undertakings, Mr. West would like to see
provision inserted in the standard contract clauses to the effect
at all goods or parts under the contract shall be British made.
triotic gas undertakings ought to have no objection to this.
e also thought it should be possible to draw up some agreement
th regard to dealings with concerns in which German capital
ists. All the views expressed found acceptance among the
embers; and it will be interesting to watch for the upshot if
e Council of the Society decide to enter into communication
the subject with the Council of the Institution. There is one
ing certain, which is that those controlling the gas industry
the country must, if they are wholly patriotic, see to it that,
ither now nor in future, they do anything that is avoidable to
ntribute to the wealth of countries that are now our enemies.

servation and Price of Sulphate of Ammonia.

A circular-letter of considerable importance has been sent
t by Mr. D. Milne Watson, the Chairman of the Sulphate of
nmonia Association, regarding the question of the quantities of
lphate of ammonia to be reserved for home use, and the prices
be charged. There has had to be some modification of the
ginal agreement in reference both to quantity and price; and
these points the letter gives full particulars, as well as in
ation to other details upon which makers will desire to be
ormed. An interesting matter is that the Board of Agriculture
ve decided to send out a pamphlet recommending farmers to
e sulphate of ammonia on autumn wheat. This act will hold
vantage for the future home use of sulphate of ammonia.
rther, as reduction of imports and increase of exports gener-
y are among the lines of financial improvement for the country,
e less nitrate of soda the country imports the better.

s as a Case-Hardening Agent.

The second paper which Professor A. H. White and Mr.
mer T. Hood presented at the meeting of the Michigan Gas
sociation dealt with the subject of gas as a case-hardening
ent; and it will be found as practical and valuable as the one
the heat treatment of iron and steel in a neutral atmosphere.
om the paper (the text of which is given in other columns), one
rns why coal gas or carburetted water gas is pre-eminent
iong carburizing agents in the process of case-hardening. Not
few readers know anything more about the process than is
ulged by the descriptive term. The paper will enlighten them.
also discloses why solid carburizers are not so good as gaseous
s. The action of the former is due primarily to the gases
y evolve; and therefore it is easily understood that there will
depreciation of activity as emission of the gases declines.
ith a suitable gaseous carburizer, uniformity is assured. The
thors discuss the use of carbon monoxide, hydrocarbons, and
l cyanogen as carburizing agents; and from the discussion one
led to see why coal gas or carburetted water gas is *par excel-*
ce the carburizing agent. Carbon monoxide, used alone gives a
e low in carbon, and so it is a poor carburizer. Hydrocarbons
much stronger; methane being the most stable. Carbon
noxide, giving a gas low in carbon, works better if enriched
h a more active carburizer. Thus a mixture of carbon mon-
de and hydrocarbons gives the best results. Cyanogen car-
izes very energetically; but it produces a case which is high in carbon, with an abrupt change between the carburized part and the central core, which is not carburized.

Why Town Gas Excels.

Of course, the advantages of town gas in case-hardening operations have been recognized for a long time now; hence its adoption. Efficiency, equality, and controllability have placed it in the forefront for the purpose; and its application is growing fast. The results have not, in the hands of some operators, always been all that could be desired; but the consistent high-level results achieved by others have proved applicability, and have gained for the process large adoption. Apart from controllability, the valuable effect produced by the use of town gas as a carburizing agent is due to this: When the gas is introduced in a slow stream into the carburizing retort, it breaks down—the hydrocarbons changing to free carbon and hydrogen, and the carbon dioxide and water vapour present react, forming carbon monoxide and hydrogen. The results of the experiments show how the rate at which the gas is conducted through the apparatus affects the carburizing. A practical operating rule is that the gas should be run into the carburizing chamber at such a rate that there will be a light deposit of carbon on the iron being carburized. If an attempt is made to carburize rapidly at high temperature with coal gas or carburetted water gas, a too hard and sharply marked case results. But case-hardening at a high temperature for a relatively short time, and then turning-off the carburizing gas, and allowing the hot metal to soak in the furnace, will cause diffusion of the carbon towards the interior, and so any desired type of case can be obtained. To both the gas and metallurgical industries, studies such as this of Professor White and his collaborator are of considerable importance.

PERSONAL.

Mr. William Russell, who has been Assistant Gas Manager at Grangemouth for the last two years, has been appointed Gas Manager at Kincardine-on-Forth.

Among current staff changes in connection with the Gas Light and Coke Company, it is announced that Mr. C. G. Langford has been appointed an Assistant Engineer.

Sub-Lieutenant F. Watkinson, son of the late Mr. J. G. Watkinson, proprietor of the firm of Messrs. J. & W. B. Smith, of Farringdon Road, E.C., has been promoted to Lieutenant. The firm have now 31 of their men serving with the Colours.

The Keith Gaslight Company have appointed Mr. James Boecher, of Aberfeldy, as Gas Manager in the room of Mr. John Cay, who resigned after 27 years' service. Mr. Boecher was previously in the employ of the Kirriemuir Gas Company.

On the outbreak of war, the Editor of the "Croydon Co-Partner," Mr. W. H. Topley, joined his regiment, the East Kent Yeomanry; and he has since obtained a Commission in the 12th County of London, where he acts as Transport Officer.

Mr. John Hunter, Managing-Director of Sir William Arrol and Co., Limited, has resigned his seat on the Board of the Company, and has accepted the invitation of the Minister of Munitions to become Director of Factory Construction in connection with the national projectile factories now being erected in various parts of the country.

Members of the gas profession throughout the country will be pleased to learn that Mr. W. Doig Gibb, M.Inst., C.E., after his rest from professional duties, is now devoting part of his time to work for the country. It was felt that his technical knowledge would be of considerable assistance to those who have been labouring so assiduously, and with such good effect, in the High Explosives Department of the Ministry of Munitions, and that, with such a well-known member of the gas profession there, the cordial relations which have been so quickly established between the department and most gas undertakings would be still further strengthened. Mr. Gibb has undertaken to devote a number of days each month to the work of the department, so as to leave the remaining days entirely free to devote to his own consulting gas practice.

On relinquishing his position as Engineer of the Nechells works of the Birmingham Corporation Gas Department, so as to become Chemical Engineer to British Dyes, Limited, Dr. W. B. Davidson was presented with a silver tea and coffee service, with a salver, which was inscribed: "Presented to Dr. W. B. Davidson by the staff and workmen of the Corporation Gas Department, Birmingham, on his resignation as Engineer of the Nechells works, August, 1915." In making the presentation, Captain R. S. Hilton (the Secretary and Manager of the Gas Department) said he hoped Dr. Davidson would look upon the gifts as a reminder of his connection with the Gas Department. They trusted he would attain to higher distinction in the chemical world. His ability ensured for him a great name. In the course of his reply, Dr. Davidson expressed his regret at leaving the Nechells works.

ELECTRICITY SUPPLY MEMORANDA.

THE men of the electrical industry, we know, are keeping sharp observation upon the gas industry at the present time. It is stated that some of our electrical friends are rather envious of the position that the gas industry has taken in connection with the war. The industry has proved an invaluable asset to the nation; and without its help the enemy might have overrun Europe, and the consequences would have been extremely unpleasant for the British Isles. Germany at the beginning of the war had what this country had not got—an abundant supply of high explosives; and the British gas industry came to the rescue of the homeland by setting to work to recover benzene and toluene so as to repair the neglect of the past in the matter of the storage of the essentials for, and the provision of, high explosives. Picric acid was required from tar to serve as the base for lyddite, melanite, &c. Sulphuric acid was also required in large quantity; so was carbolic acid. There is definite information that the gas industry is to be called upon to do still more in this line. In another direction, some gas undertakings in large industrial areas are operating under extraordinary conditions through the supply of light, heat, and power for the manufacture of munitions. We have reported that at Birmingham the consumption of gas in the last six months was 13¼ per cent. greater than during the corresponding six months, owing to, as Sir Hallewell Rogers says, almost every Government contractor for munitions employing gas for lighting, heating, or power, or for one or more of these purposes. The metallurgical industries, for example, are in some places working double shifts. Such a condition was unforeseen; and the Gas Committee of Birmingham have, pending the installation of additional carbonizing plant, had to ask consumers to economize their gas consumption during the coming winter months; and this notwithstanding reduced street and shop lighting. This big rush for gas has occurred not only in Birmingham, but in other great industrial centres; and this simultaneously with the enormous reduction of gas-works labour, owing to recruiting and munitions work.

National Service.

Fluctuating Industrial Demand.

Of course, electricity is totally incapable of entering into competition with gas in the metal industries for many operations to which the latter is now applied, and for three reasons: Because electricity is in comparison not in the same street for thermal value; because it cannot vie with gas in economy; and because the properties of gas render it of exceptional value for the processes of annealing, hardening, &c. We might add a fourth reason—that electricity, through the lack of substantial storage, could not possibly meet, without considerable cost in stand-by plant and increased daily outgoings, the heavy fluctuations in demand from hour to hour, and from day to day, that have to be encountered by the gas industry. We have seen what an immense average increase Birmingham has had to meet in the last six months; and it is stated that, for heating and power, the Sheffield Gas Company are sending out about ten times more than they were doing for these purposes before the war. The figures are averages, and do not indicate what considerable peaks and valleys there are, in many cases, in the output curve from hour to hour and from day to day. A few days ago, we heard of one gas concern in an industrial area, the output of which since the war began has shown a good average percentage increase; but the manager never knows in the morning what the day is going to bring forth. He has had days with 12 to 16 per cent. increase upon the day before, or upon the corresponding days of the previous year; and he has had days showing actual declines in output in comparison with the preceding day or the corresponding days of last year. This is due to the fluctuations in the character of the work proceeding in the factories in the supply area. Such variations would not, to put it mildly, be convenient nor a matter of comfort to the central station engineer.

Competition under the Circumstances.

Of course, this enormous pressure in gas demand for industrial purposes is not general in the gas industry; but it may be said that national service in the provision of the essentials for high explosive purposes is practically universal. The country cannot afford that this should not be so. But all the conditions, it is plain, are against maintaining the standard of efficiency in trading competition at the highest level attained before the advent of these abnormal times. Of course, the men of the electrical industry will say that in some industrial areas they, too, are feeling the pressure of demand for power purposes, and that their competitive strength is seriously crippled (this applies equally to those gas undertakings without a good balance of cash in hand) by reason of the withholding of sanction to further spending powers, unless the expenditure is required in connection with munitions output. They, too, are short of men for dealing with expansions of business. Under the circumstances, the one industry cannot take much advantage of the other in unduly pressing competition. In fact, we should look upon it as a not very patriotic thing when one concern is working at high pressure to meet the country's needs for the competing concern, less pushed, to use the opportunity to enhance its own advantage. It would be tantamount to one man striking another who has his hands tied behind him.

A Newcastle Condition.

The Newcastle-on-Tyne Electric Supply Company and the associated concerns appear to us to be trying to evade the stipulation as to preference being shown to any consumer or class of consumers. According to one of our electrical contemporaries, they have introduced a new charge, to be known as the "domestic." Under this, the consumer pays a settled charge on the lighting installation on the basis of 6s. per lampholder per annum. The charge, however, is made on only 75 per cent. of the total lampholders fitted; but "the tariff is conditional upon the consumer installing electricity for lighting purposes throughout." The fixed charge is payable in full for the first year, and in subsequent years at the rate of one-third for each winter quarter, and one-sixth for each summer quarter. The charge per unit above this is ¾d., without meter-rent. As to the tariff being "conditional upon the consumer installing electricity for lighting purposes throughout," in the South London case the Company made the same stipulation. At the instance of the South Metropolitan Gas Company, they had to withdraw it. In the Long Eaton case, consideration was shown to power consumers on condition that they used electricity only for lighting purposes. The local authority had to withdraw the stipulation.

A Confession of Ignorance.

Petty comment is made by "Electrical Industries" upon our recent editorial article regarding the position of the gas industry in relation to lighting competition; but throughout the comment, there is not a single piece of evidence offered to destroy the accuracy of our contentions. Take this as an example: "It is sheer nonsense to suggest that gas has anything comparable with the convenience and excellence of indirect and semi-indirect illumination by electricity." Why it is "sheer nonsense" our contemporary is careful not to explain. Of course, samples of indirect and semi-indirect lighting using incandescent gas-burners did not happen, at the National Gas Exhibition and at the Ideal Home Exhibitions, to meet the eyes of the writer of "Gossip" in "Electrical Industries." He has never seen any illustrations in our columns, and in the illuminating engineering papers, showing the application of these systems to gas lighting. He never knew that Mr. William Sugg adopted the semi-indirect system for gas lighting for its decorative and diffusive effects before the electricity industry was compelled to utilize it for protecting people's eyes from its malignant glare. Take another statement: "Gas is *alleged* to have the advantage of lower intrinsic brilliancy, better composition [of light], and diffusive power." "Alleged!" That is the most, simply insinuating the contrary, that our contemporary has to say. Our electrical readers—and they are not few—will look upon their champion's comments as very weak. Now we invite him to show us positively where our statements in these respects erred, by giving us authoritative data supporting his contentions. Then we promise to discuss the matter very seriously with him.

Fittings and Deceptive Prices.

The same "gossiper"—gossip is generally flimsy and unreliable—not very generously agrees that "gas-fittings have been brought to a high pitch of perfection," but he spoils the admission by adding "in imitation of electrical fittings." As a matter of fact, electrical fittings have been developed by the experience gained by the manufacturers of gas-fittings; and the manufacturers of gas-fittings—particularly in the Birmingham district—are the same people who largely supply the wholesale houses dealing in electrical fittings. There has been no imitation. To a very large extent the same fittings, in the main parts of the designs, are as suitable for gas as for electricity—in the one case gas is conducted through their tubular organism, in the other case electric wires. In the gas industry, we have nothing so ugly and so dangerous as a lamp being suspended at the end of a piece of flexible wire. As to the costs of similar fittings for gas and for electrical use, the latter puts the former into the shade. If the user of electricity desires something of an exquisite order, he has to pay very dearly for the gratification. The "Electrical Times" also complains of a piece of deception practised by the purveyors of electrical fittings through their catalogues. Illustrations are given showing fittings complete with shades, holders, wiring, lamps, glasses, and presumably with lead shot in the counterweight for rise-and-fall pendants; but the price quoted merely covers the body of the fitting itself. Example is given from the catalogue of the Ediswan Company, where a complete fitting is illustrated, and is priced at £4 11s. But a prospective purchaser of the fitting finds that the £4 11s. has to be supplemented by £2 4s. for the shade, by (say) 5s. for the wiring, by 16s. for half-a-dozen lamps, by 11s. 3d. for three glasses for the upper lights, by 2s. 6d. for the lead shot, by 4s. 6d. for the six holders, and by 1s. for the ceiling block. Thus the essential accessories run the consumer into a further outlay of £4 4s. 3d.; making the cost of the fitting complete £8 15s. 3d. We should want for the price something extraordinarily gorgeous in the way of a gas-pendant, with all fittings. Gas-fitting catalogues also illustrate pendants complete; but they invariably show what the shade and burners (of the size illustrated) cost in addition.

Losses at Dundalk.

There is often a considerable difference between the reports of interested people and actual facts. The Germans are past-masters at this sort of thing. According to their reports, they repulse attacks as frequently as they are made; and their arms meet with success everywhere. The accumulations of what they have done and are doing according to the reports issued from Berlin ought before this to have carried the German-Austrian armies over the face of the entire Continent. But on the Western and the Eastern fronts, they have stuck fast. The electricity concern at Dundalk, according to one of our electrical contemporaries recently, was showing excellent progress. But when this comes to be translated into figures, we fail to see that there is anything about which to boast. Mr. George Airth, the Engineer and Manager of the Dundalk Gas Company, has occasionally let a little light upon this question; and now Mr. J. A. Reddy, the District Auditor, has in his report been making two or three revelations that are not altogether to the taste of those responsible for the administration of the electricity concern. He states that, in the accounts of the Electricity Department, the figures shown in the abstracts under the head of repayment of loans do not include the full sum due for the entire period—the balance having been paid out of the general town fund. Further, from the commencement of the undertaking up to March 31, the total sum paid in support of the concern out of the general fund amounted to £2068. It is probable this amount will be largely increased under present circumstances. There is nothing to be proud about there. Mr. Reddy also says that he noticed one or two cases in which the charges were not in accordance with the printed tariff; but he understands the tariff is under revision. There is nothing to be proud about in secretly departing from the tariff. It would be interesting to know if these people were receiving preferential treatment in contravention of the law governing the matter of charges.

Importance of the Salesman.

There are salesmen and salesmen; there are salesmen who are good, and salesmen who are bad. We have met both types; and the only results of contact with the latter have been to be very sorry for the want of ability on the part of the company or firm in choosing such representatives, and an expression of fervid hope that we shall never meet those salesmen again in, at any rate, a business capacity. Some salesmen do to the business of the concerns to which they are attached more harm than good; and therefore the quicker they are cleared out, the better. There was recently an article in the "Electrical Review" on the subject of the importance and training of the salesman; but the article starts with this most unhappy passage: "The salesman may be considered the life-sap to any concern, as upon the results of his activities the success of all industries depend." There is a grammatical error there through the omission of an "s;" and it is going rather far in claim to say that on the results of the activities of a salesman for one concern the success of "all" industries depends. However, there it is; and it is the considered opinion of Mr. R. P. Bennett, the author of the article. Still the importance of the salesman in creating business is great, as upon the results of his work the general development of the whole undertaking depends—from productive plant outwards, no matter the nature of the commodity. The company or firm may produce their commodities efficiently, and prices may be very moderate. But given bad salesmen (and, in the gas and electricity industries, bad fitters), the interests of the company or firm are seriously imperilled. Mr. Bennett advocates the salesmen-training methods that are in operation in the United States. They are somewhat elaborate. Nevertheless, there is something in the idea that the salesman should have a technical knowledge root and branch of the business, so that there shall be no danger of him damaging the interests of his employers by inadequate knowledge. In the works or factory, he is made acquainted with the methods of production and distribution, and, in the case of goods, of handling, packing, and dispatch. The training proceeds for a definite time in each of the departments. Then a period is spent in the administrative offices. Succeeding, time is passed in a preparatory school, where the methods of approach, attack, and the display of samples are learned. Then there are rehearsals in which a director of the company or firm is a supposititious customer, with whom the salesman seeks an interview, expatiates upon the goods he has for sale, and tries to effect a transaction. This must be a critical time in the career of the salesmen. But, of course, a successful salesman is born, not made; and no two possible customers with whom he will have to deal are exactly alike. While a full range of knowledge is therefore correct, it would be worse than useless to have the salesman tied up with formulæ, or to be incapable of action save in a mechanical sort of way. Though a salesman is born, and not made, his abilities want to be cultivated and specialized; but in the gas industry, we have seen all too little of the effects of such work—to the detriment of the industry. It is by some salesmen thought sufficient if they can talk of consumptions and capacities; beyond these particulars they get out of their depth, which should not be in an industry with technical foundation, and the progress of which is opposed by the sternest rivalry.

Mr. Thomas Bower, M.Inst.C.E., late of West Hartlepool, by will just proved, left estate of the gross value of £33,935.

THE COKING OF COAL AT LOW TEMPERATURES.

By S. W. Parr and H. L. Olin.

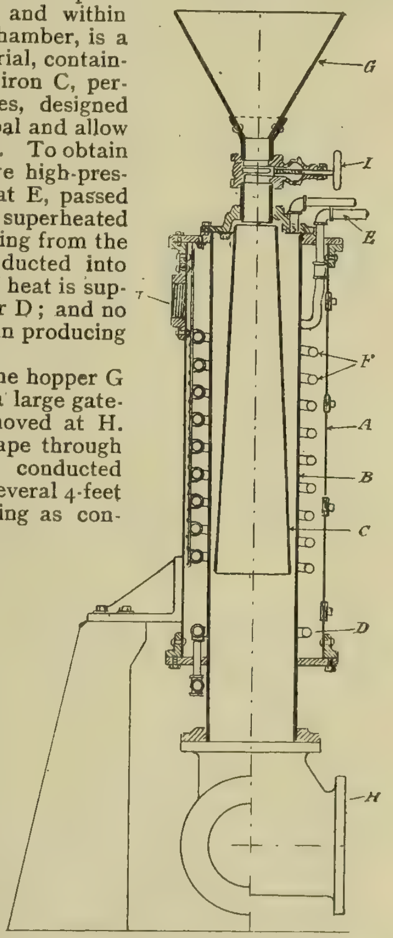
A "Bulletin" issued by the University of Illinois, just received, bears the title given above, and is a continuation of a former one [see "Journal," Vol. CXXII., pp. 533, 595]. The present experiments cover a series of studies made during 1911-13, on the coking properties of Illinois coal.

Previous experiments have shown that the formation of coke depends upon the presence of certain constituents having a melting point which is lower than the temperature at which decomposition or carbonization takes place. These products are, however, readily and easily oxidized, and the greatest coking effect is obtained where the opportunity for the minimum amount of oxidation has occurred.

Coals containing an excessive quantity of the coking substance produce a light, porous coke; the texture being modified by pressure and close packing of the charge. By the use of temperatures between 400° and 500° C. (752° to 932° Fahr.) the resulting products are of a type distinctly different from those obtained by the usual high-temperature procedure.

In the present research, the experimental apparatus was designed to carbonize about 100 lbs. of coal. It is shown in detail in the diagram, where A is a boiler-plate shell lined with asbestos, and within this, forming the coking chamber, is a shell B, of the same material, containing a cone of light sheet iron C, perforated with $\frac{3}{16}$-inch holes, designed to confine the charge of coal and allow free circulation of the gases. To obtain a non-oxidizing atmosphere high-pressure steam was admitted at E, passed through F, where it was superheated by the hot currents ascending from the gas-burner, and then conducted into the coking chamber. The heat is supplied by a blast ring-burner D; and no difficulty was experienced in producing the desired temperatures.

The crushed coal from the hopper G enters the retort through a large gate-valve; the coke being removed at H. The combustion gases escape through J; the distillates being conducted through an outlet pipe to several 4-feet lengths of 1-inch pipe, acting as condensers. The tars pass through a water-sealed exit at the bottom; while the gases, fairly clean, are collected in a holder.



Cross Section of Apparatus for the Low-Temperature Distillation of Ccal.

As the heating progressed during the installation, a black pitchy substance dropped from the joints of the containing ovens; but it hardened immediately upon cooling, forming a brittle mass much resembling asphalt. This is undoubtedly the cementing principle which is instrumental in forming coke. In the decomposition of the resinic bodies, and in the deposition of cementing carbon, there occurs at the same time an evolution of large quantities of gases, which inflate the pasty mass and make the resulting coke more or less light and spongy—so much so, that certain coals, after being heated under conditions which allow free expansion, present the appearance of hardened froth, because of the excessive development of cell structure in the coke. This effect can be largely reduced by the application of pressure during the carbonization of the charge of coal or by the addition of inert coke dust to the coal before charging.

A sample of such a coke-breeze had the following composition:

Moisture . . .	1·85	Sulphur . . .	2·62
Ash	11·90	Fixed carbon . .	66·40
Volatile matter .	19·85	B.Th.U. . . .	11,243

With one particular coal it was possible to add 100 per cent. of this material and still produce hard, firm coke. Not only is the texture made firmer by this treatment, but the density is greatly increased.

Early in the course of the work, the study of the products resulting from the distillation of bituminous coals at low temperatures suggested the possibility of using them as fuel for gas-producers. Previous experiments showed that the moderate temperature of the preliminary heating period was sufficient to expel the major part of the tar-producing substances, and that the residue yielded gases that were remarkably free from heavy condensation products.

The producer used was a No. 3 Otto, designed to operate on anthracite pea coal. The fuel used was the semi-coke obtained at 400° to 550° C. It was light and porous, and varied in size from ¾ inch to 2 inches diameter. Its composition was approximately that given above. No trouble was experienced in working other than that due to the lightness of the material, which necessitated the fuel being poked about once in an hour, to cause it to feed as rapidly as it was burnt. The producer gas contained:

	Per Cent.		Per Cent.
Carbon dioxide . .	4·15	Hydrogen (estimated) .	11·80
Carbon monoxide .	21·10	Marsh gas.	1·50
Oxygen	0·30	Nitrogen	61·00

The efficiency of the producer worked out at:

	Per Cent.
Grate efficiency	98·2
Hot gas efficiency based on high heating value . . .	74·4
Cold ,, ,, ,, low ,, ,, . .	64·9

A test of some of the original low-temperature coke in an ordinary house open fire grate showed that the coke ignites readily, it retains its shape through the process of combustion, a glowing bed quickly results, and no smoke is produced. An analysis of the tar produced at the low-temperature distillation of coal showed:

Below 210° C.	17·2 per cent.
210° to 325° C.	52·7 ,,
Above 325° C.	30·1 ,,

Further fractionation of the light oil fraction (up to 210° C.) yielded the following:

Specific gravity, ·966.

	Percentage on Basis of Crude Tar.		Percentage on Basis of Light Oil Fraction.
Light oil fraction	17·20	..	100·0
Phenols (and other acid substances) .	5·70	..	33·0
Amines (and other bases)	0·90	..	5·3
Paraffins	3·12	..	18·1

A further refractionation after acids and bases had been removed gave:

Between 20° to 75° C.	0·25	..	5·26
75° to 95° C. (crude 90 per cent. benzol)	0·38	..	2·10
95° to 125° C. (crude toluol) . . .	1·33	..	7·36
125° ,, 170° C. (crude solvent naphtha)	4·77	..	26·30
170° ,, 200° C. ,, heavy ,, .	2·67	..	14·73
200° ,, 210° C. ,, ,, ,, .	1·32	..	7·30

Naphthalene is absent; and the free carbon in the crude tar is less than 2 per cent.

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A CHEMICAL INTELLIGENCE DEPARTMENT OF THE BOARD OF TRADE.

A long discussion took place at the meeting of the London Section of the Society of Chemical Industry yesterday (Monday) week with regard to a scheme by Dr. M. O. Forster for the establishment of a Chemical Intelligence Department as a branch of the Board of Trade. Dr. H. E. ARMSTRONG was in the chair.

Dr. FORSTER, who put the proposal forward originally at the annual meeting of the Society in Manchester a short time ago, explained it a little more in detail. He complained of the neglect of chemistry in this country both by the general public and the Government, the result of which had been to put us, on the outbreak of war, at a serious disadvantage compared with Germany. Unless definite steps were taken to establish chemistry upon such a footing that it could assume its proper place in the national economy, the restoration of European peace would be the signal for the restoration of British chemistry to its former ignominy. Those who had striven in the past to improve the status of the industry had failed through circumstances being too strong for them. The moment, however, was opportune for a scheme of the nature he had in mind, because the Government was now taking the advice of chemists to an extent hitherto unknown. Briefly, the scheme is to institute a branch of the Board of Trade as a Chemical Intelligence Department, the work of which might be subdivided as follows:

A.—TECHNICAL.

1.—Classification of chemical discoveries at home and abroad as evidenced by (*a*) patent specifications, (*b*) scientific memoirs.

2.—The distribution of chemical information to scientific inquirers and to manufacturers seeking new developments or desiring to improve existing processes.

3.—Collection of information regarding the most suitable materials for constructing chemical plant and apparatus on a manufacturing scale, and the most convenient sources for the supply of such plant and apparatus.

4.—Tabulation of the bye-products arising in various chemical industries, and consideration of the most profitable ways of utilizing them.

5.—Presentation of problems arising out of (3) and (4) to the numerous research chemists throughout the country, such problems to be offered under proper discretionary safeguards and appropriate remuneration.

B.—TECHNO-COMMERCIAL (By Co-operation with the Board of Trade).

1.—Classification of various chemical products in respect of their distribution throughout the world, with ruling prices, tariffs, cost of transport, and, where possible, cost of production.

2.—Classification of resources of the Empire and friendly nations of raw materials for the purpose of finding novel applications of them.

C.—TECHNO-EDUCATIONAL (By Co-operation with the Board of Education).

1.—Classification of data regarding opportunities for chemical instruction and research in various parts of the Empire, and comparison of these with those offered in foreign countries.

2.—Consideration and possible improvements and extensions in existing Imperial methods suggested by the information thus gained.

3.—Consideration and, where possible, application of methods by which wage earners of good conduct and adaptability might be trained as technical foremen.

The cost of working such a department the speaker put at, roughly, £5000 per annum; the staff consisting of a controlling chemist, four or five assistant chemists, a librarian, and a clerical staff of six or eight.

Mr. WALTER REID, Dr. ALEXANDER SCOTT, and Mr. GORDON SALAMON supported the scheme in general. The first-named, however, hoped everything would be done to prevent any interference with the work of consulting chemists. Mr. Salamon pointed out that, unless care was taken in working out the details of the scheme, there was a danger of it being known as one for the synthetic production of red tape. It would be better for such a department to work in co-operation with all the Societies in the industry, who should appoint a Joint Committee to supervise the work.

Professor DONNAN agreed with this view.

Mr. J. L. BAKER said there was at present a Committee representing all the chemical societies; and if this were to do its work properly, it should be able to carry out a lot of the pioneer work, and devise a definite scheme by the time the war was over.

Mr. E. J. BOAKE, Dr. F. M. PERKIN, and one or two other speakers emphasized the point that any such department as that proposed should be paid for by British capital, and the information made available only to British chemists. They also supported the suggestion that an Advisory Committeee appointed by the various Chemical Societies of the country should control the new department; the members of such Advisory Committee being varied from time to time in the same way as the members of the Advisory Board of the National Physical Laboratory.

Dr. TRAVERS doubted whether such a department could be run for £5000 a year. In his opinion, the controlling chemist should be paid £1000, and his assistants £500 a year. At the same time he failed to see how the information which might be obtained by the Department would benefit manufacturers, seeing that it must come from the manufacturers in the first place. He thought that there was a great need for the chemical industry to organize itself.

Mr. C. S. GARLAND expressed similar views, and advocated a combination of all the Chemical Societies into one, the work of which should be subdivided in such a way that chemists could subscribe to the section which dealt with their particular interests. In this way he anticipated good results.

Mr. W. J. A. BUTTERFIELD foresaw that the proposed department would be made use of by two classes—namely, prosperous manufacturers who might be of a mean turn of mind and hoped to get useful information without paying for it, and, secondly, the impecunious inventor or manufacturer, who looked to the State to help him with advice so that he might become prosperous. He failed to see how the department, if it were to be of any use, could work without the advice of consultants and technical men; and surely these should be paid professional terms. No account of this had been taken in the estimated expenditure.

Dr. D. A. SUTHERLAND and Dr. MIALL also held the view that the chemical industry needs organization within itself before approaching the Government with any scheme.

Representatives were present from the Board of Trade and the Board of Education; their function being to report to their representative Presidents their views of what took place.

The CHAIRMAN, in winding-up the discussion, said that the very fact that two representatives of Government Departments were present and maintained the old-fashioned aloofness, was an indication of the necessity for change of some sort in the relations between the Government and industry. Evidently this matter must be taken up by the Society of Chemical Industry and the other Societies in the industry, and a scheme formulated so that the Government should not be merely asked, but should be required to take steps. In supporting the suggestion that an Advisory Committee should be formed to control the Department, he said chemists could not be spared to be appointed as permanent officials. They were badly wanted in the factory, and, moreover, men put to ornamental work of this kind could not keep in touch with the industry.

Dr. FORSTER briefly replied; and the matter will now be dealt with by the Council of the Society.

SOCIETY OF BRITISH GAS INDUSTRIES.

The Autumn General Meeting was held on Thursday last, at he Trocadero Restaurant, Piccadilly Circus, W. Alderman F. EMPLER DEPREE, J.P., the Chairman of the Council, presided ver a good attendance of members. Upon this the Chairman, n opening the proceedings, expressed congratulations, in view of he fact that so many of the firms are working hard for the overnment on munitions.

APOLOGIES.

The CHAIRMAN remarked that he had to explain that the Vice-hairman (Mr. H. M. Thornton) had been suddenly called away, nd regretted very much that this prevented his appearance at he meeting. They had also a letter, written on behalf of the resident (Sir Alfred Keogh, K.C.B., LL.D.), explaining the cause f his absence.

The SECRETARY (Mr. Arthur L. Griffith) read the letter, which tated that Sir Alfred had asked the writer to express his regret hat he could not take the chair at the meeting, as he would have ked to do. His work at the War Office quite precluded his cceptance of any other engagement, which, as might be imagined, as very heavy as well as onerous.

REPORT ON THE WORK DURING THE PAST SIX MONTHS.

The CHAIRMAN then read the following statement:

In presenting this brief report of the transactions of our Society uring the past six months, it is not my intention to detain you at ny length, because I consider that, at a meeting of this kind, more ood can be obtained by free discussion among the members themlves, with possibly some hints for future working and developent, than by listening to a cut-and-dried statement of what has ready taken place.

The one formal announcement of importance I was desirous make was with reference to our new President for the coming ar; and this I am not at present in a position to do. We are all lly aware of the reasons that have, unfortunately, deprived us of e presence and assistance of our esteemed President, Sir Alfred eogh, and can but regret that the condition of the war necessites his still devoting his full time, and all his energies, to carryg out the important duties he has been called upon to render the War Office and to His Majesty's Army. The matter of the mination of a successor to the presidency has been left in the nds of Mr. Yates and myself.

During the past few months most of our members have been ry busy on munition work for the Government. A Sub-Comittee was appointed by the Council in July last to see in what ay the members could help each other in this matter. Meetings ere held and a letter sent to all firms in the Society, and a sumary of the replies received was tabulated, by which it was found at most of the firms were either fully or partly engaged on war unitions. It was thought desirable to bring firms who can dertake more work into touch with one another; and lists setting t those in the various districts were sent to all firms from whom plies had been received. The Council hope should any firms t inquiries, either direct from the War Office, Admiralty, or their cal Munitions Committee, and find that any contract obtained is eater than they can undertake, or there are parts they require d do not themselves manufacture, they will get into touch with y of the firms set out in the list. I am pleased to report that, om a number of letters received, our members expressed their preciation of the action taken by the Council. The Secretary the Society is at all times willing to place his services at the sposal of any members for this purpose.

Your Council have invested the sum of £100 of the Society's nds in the new 4½ per cent. War Loan.

The King paid a visit to Leeds at the end of September and ent several hours visiting munition factories. He also visited e Leeds University, and—under the guidance of Professor thur Smithells, one of our Vice-Presidents—was taken through e various departments. In the Chemical Lecture Theatre there as a demonstration of the use of poison gas in warfare. In the epartment of Coal Gas and Fuel Industries His Majesty noted e important work which is being carried on in regard to the pply of explosives.

In connection with the work at Leeds University on ventilation search, it is interesting to note that the Gas-Stove Section of r Society has been making experiments on the subject for any months past, and the following remarks in Professor Cobb's nual report are of great interest at the present time:

> Most immediately applicable to practice is probably the demonstration that even the most modern types of gas-fires differ so much among themselves in the degree to which they effect the ventilation of a room when burning under the same conditions. The usefulness of the work of this course will not, I think, be questioned.

It is very pleasing to note that, at the invitation of the Institun of Gas Engineers, Professor Cobb has joined the Committee Refractory Materials, in which question our Society has taken deep an interest.

The Joint Committee of members of the Institution of Gas Enneers and our Society who are holding an inquiry on the life of s-meters have reported that progress has been made with the preliminary work of the investigation; and we hope that satisfactory results will follow on their deliberations. We regret to have to record the death of Mr. Edward Allen, one of the members of the Institution on the Committee, and also of Mr. Joseph Hepworth, one of the members representing the Society—both of whom took a great interest in the matter. The Institution have suggested that the two vacancies on the Committee should not be filled up; and this has been approved by our Council and the members of the Meter Section. Reference must also be made here to the loss that we have all sustained by the death of Professor Vivian B. Lewes. Many of us who have had the opportunity of meeting him, more particularly in the demonstrations that have from time to time taken place in the gas industry, knew him as a clever and genial lecturer. As such, there was no one who could approach him in the gas trade or any other trade. I feel that his loss is a very personal one, and that all those who had the pleasure of knowing him well, as I did, sincerely mourn his loss.

The British Commercial Gas Association is continuing its good work; and its advertising propaganda is being pushed forward in spite of these troublous times. We hope all the members of our Society will show appreciation of their action by giving it their best support, as the work that is being done must be for the benefit of every firm connected with the industry.

The Society's prizes to students in connection with the City and Guilds of London Institute examinations in Gas Engineering and Gas Supply have been awarded as follows:

Gas Engineering—Honours Grade.

1st Prize, £3 3s.	Leonard Howard Thomas, Draughtsman in the Nechells works of the City of Birmingham Gas Department.
2nd Prize, £2 2s.	Wilfred Baker Claridge, Assistant at the Gas-Works, Harpenden, Herts.

Gas Supply—Honours Grade.

1st Prize, £3 3s.	John Tattersall Haynes, on the Engineer's Staff of the Liverpool Gas Company.
2nd Prize, equal, £1 1s. each	Albert Harry Manning, Chemist and Draughtsman to the Rotherham Corporation Gas Department. Leonard Howard Thomas.

From acknowledgments received, these prizes were much appreciated. We are pleased to congratulate Mr. Thomas on his dual success.

To encourage students in gas-fitting, the Council have decided to offer the following yearly prizes in the examinations:—

First prize, Honours Grade	Three guineas
Second prize, do.	Two guineas

As, however, the examination this year (being the first one) was of an experimental character, it has been decided, on the advice of the Secretary of the Examinations Board, not to award these prizes until next year.

The Institute of Industry and Science having asked the Society to furnish replies to certain questions in reference to credit facilities given by British banks, as the London bankers were going to consider the whole question, a letter was sent out to all our members; and as a result a considerable amount of valuable information was obtained which was summarized and sent to the Institute, from the Chairman of which we received a letter of thanks, stating that the summary was a most interesting document and would be of great assistance in developing the question at issue. We trust good may result from the bankers' deliberations.

With regard to the shortage of railway waggons which was referred to by the late Chairman, Mr. Broadhead, at the annual meeting in March last, we are pleased to report that the proposal for the pooling of railway trucks has not been lost sight of—representations having been made to the Government and the Railway Clearing House, as at a recent meeting of the Coal-Mining Organization Committee at the Home Office the views of supporters of the scheme which suggested that not only would its adoption save labour but that goods transport would be facilitated and cost of carriage be proportionately reduced, strongly appealed to the Committee, who adjourned the meeting so that an opportunity might be afforded of meeting the Railway Managers and placing the scheme before them. We feel sure that the scheme, if carried through, will be of great benefit to our members in all parts of the country, and to traders generally, and hope it will be decided upon by the Government. I am sorry Mr. Broadhead has not heard anything further about this matter.

I shall now be pleased to hear any remarks upon the report.

DISCUSSION.

Mr. J. W. BROADHEAD thought the members would all agree with him that the Chairman was to be complimented on his report. It showed that the Society had been doing a large amount of work during the past half year; and it was, in fact, even more than was reflected by the report. However, it indicated that the Society was continuing its good work, and was deserving of the full confidence and support of the members. With reference to the visit of His Majesty the King to the Leeds University, he (Mr. Broadhead) had the pleasure, as the Society's representative on the Livesey Memorial Committee, to be present on the occasion. The other side of the gas industry was represented by Mr. John Bond, of Southport, who went at great inconvenience, owing to the short notice he received. However, the King's reception was quite an informal one. Regarding the question of railway waggons, he was sorry to say that the efforts that had been made to secure improvement had not yet borne fruit; and he was afraid that it came to this, that, if anything was going to be done, it would have been accomplished before this. Business had undoubtedly been very much hampered, not only through shortage of trucks, but owing to the railway lines having been periodically closed for military purposes, which could not of course be avoided. The pooling of the different railway companies' waggons would, there was no doubt, have very greatly improved matters. The Chairman had made a few remarks regarding the British Commercial Gas Association, and had spoken about the support that the Association deserved from the members of the Society. He (Mr. Broadhead) thought the members would agree with him, that the Association was doing an immense amount of good, and that every penny that was subscribed was expended in a useful way. Some members of the gas-supply industry, however, thought that the members of the Society were not doing so much as they ought to do. But he considered that £2000 odd out of a total of £15,000 was perhaps not really an amount of which to be ashamed, and particularly when they took into account the vastly larger capital that was employed in the manufacture of gas, as compared with that employed in the manufacture of apparatus. The gas profession were justly proud of being able to say that 80 per cent. of the quantity of gas output was represented in their subscriptions. This looked very handsome; but when they were told that out of the total number of gas undertakings, only about 500 subscribed, and not all of these on the full basis, it meant that only about 33 per cent. were subscribing. Surely, therefore, the members of the Society might say that the gas undertakings ought to do somewhat better than that. He understood from the Secretary that something like 60 per cent. of their members subscribed. However, the Association were doing their best to get all the gas undertakings to fall into line on the full basis. This being so, the Society must try to get every one of their members to subscribe on a liberal scale to the good work that the Association were doing. He thought the Chairman had every reason to be pleased with the proceedings of the Society over which he had presided so well during the last six months.

Mr. G. H. PEARSON PERRY observed, with reference to the subject of railway waggons, that there had been a great shortage; and the situation had not been much improved.

After a little more discussion, the report was unanimously adopted.

THE GAS INDUSTRY AND THE GOVERNMENT.

The CHAIRMAN said there was one topic upon which he did not touch in his report, and that was as to the result of the deputation the previous week to the Explosives Department of the Ministry of Munitions, in connection with various matters that have been brought before the British Commercial Gas Association and their own Society. The Government (through the Treasury and the Local Government Board) were withholding sanction to the raising of capital by gas companies and to loans to gas undertakings owned by local authorities for the erection of gas plant and the purchase of necessary gas appliances. Yet the Munitions Department had been issuing circulars lately pressing the gas industry to supply as great a quantity of toluol as possible for the manufacture of high explosives. The Parliamentary War Savings Committee had been urging the public to use gas and gas coke instead of coal, so as to ensure economy for themselves and toluol for the Government. The War Office and Admiralty were also calling for more men; for the employment of women in factories, on farms, and upon all classes of industrial, instead of domestic, work; and for the increased output of munitions. To reduce industrial labour, manufacturers were putting down gas-furnaces and other apparatus in lieu of coal-fired plant, as the former required far less labour to operate than the latter. To reduce domestic labour, householders were ordering gas cooking and heating stoves and gas-heated hot-water circulators by tens of thousands. For the purchase of these, either capital was required by the gas undertakings if they were lent or hired by them to the public, or the money must come out of the purse of the public if the stoves were bought by them outright. The financial effect was the same. For the production of munitions with the utmost speed and a minimum of labour, manufacturers were installing gas-engines, furnaces, and other gas-heated apparatus in large numbers. This was one side of the picture. On the other side, the War Office were not using gas as fully as they might, either in buildings taken over temporarily for Army Pay Corps and other purposes or in new premises for which a supply was available; and the Treasury and Local Government Board were refusing financial facilities to gas undertakings for the purchase and supply of gas cooking, heating, and hot-water appliances, or for the carrying out of extensions of manufacturing plant required to supply larger quantities of gas. It was urged by the deputation that the various Government Departments having control of buildings (the War Office, Admiralty, Office of Works) should be instructed to use gas wherever possible both for light and as a fuel; and that the financial restrictions imposed upon gas undertakings at present should be promptly relaxed. The deputation consisted of the President of the Institution of Gas Engineers (Mr. John Young), the Hon. Secretary (Mr. W. E. Price), the Chairman of the Executive of the British Commercial Gas Association (Mr. F. W. Goodenough), and he (Alderman Depree) as Chairman of the Council of their own Society. They had a very interesting reception from Sir Sothern Holland on behalf of Lord Moulton. The first suggestion he made was that they were applying to the wrong department. This, of course, was what was invariably done. A deputation was no sooner arranged, and somebody seen, than they were told that it was not the business of that department, but of another. Although they were talking about munitions, they were informed that it was the Board of Trade they ought to have seen. However, they impressed upon Sir Sothern the desirability of the matter being accorded some consideration; and he expressed himself as being sympathetic, and said the matter should have attention, They all knew what that meant. Whether they would be prepared to let the matter rest there he did not know. Personally, he should like to see it carried a bit farther. Mr. Mason, who was present as Secretary of the British Commercial Gas Association, was not likely to let the matter die out without some further effort. He (the Chairman) thought the members would like to know that a careful eye was being kept on the matter.

FIRMS WITH GERMAN AND AUSTRIAN CONNECTIONS.

The CHAIRMAN said there was just one other question that he wanted to mention. At the last meeting, a proposition was put forward by Mr. Glover, and seconded by Mr. Milbourne, that the Chairman and Vice-Chairman should be requested to draw up a rule to be submitted at the annual meeting in 1916, with the view of excluding firms from membership who were not acceptable to the Society. The rule had not yet been drawn up; but it did not require so long a period as from now to March next in which to do it. However, he thought that at this meeting, he would take the opportunity of drawing attention to the proposed rule. There were some firms who were subscribers to the Society who had to a certain extent a foreign connection; and it was considered that these firms, before any special rule was adopted, would perhaps like to know what was the feeling of the members, and so give them an opportunity of gracefully withdrawing. He did not think he need labour the point. Looking through the list of members, it would be seen that there were firms who, if they had not at the present time very considerable trading with German and Austrian firms, or were worked with German and Austrian money, were associated more or less with foreign trade. Under the circumstances, as this was the Society of "British" Gas Industries, it would be better for those firms to retire from membership.

THE WAR ON BRITISH TRADE.

Mr. R. J. MILBOURNE, Assoc.M.Inst.C.E., F.C.S., read the following paper on the above subject:

I should like to draw the attention of members of the Society of British Gas Industries to the articles now appearing in the "Engineer," commencing with the publication of Oct. 15. No doubt many members have had their attention already called to these articles by the well-known firm of Colonial Agents, Messrs. W. Coward and Co., of Bishopsgate, London, who are taking a very keen interest in the matter.

In these articles we are very plainly told that the Germans are already taking vigorous steps to retain, as far as now lies in their power to do so, their own foreign trade and trade connections even during the war, and to baulk and jeopardize ours and that of our Allies. It is forecasted that we are to meet competition much more severe than ever we have felt it before in the commercial war that is prophesied. We are informed in these articles that so serious a view do Russia, France, and Italy, and even stricken Belgium, take of this matter that they have Committees already at work. If Great Britain is not already engaged in marshalling her commercial forces to deal with the matter effectively with a well-thought-out policy, she may find herself as ill-prepared in regard to this matter as she was in the matter of defence at the beginning of the war.

The commercial aspect is not the only one. There is technical research, and the encouragement of invention that must not be overlooked. Mr. J. Ferguson Bell, who is well known to all of us, gave some excellent advice in an address he delivered before the Derby Society of Engineers last month. He said it has been reported through Reuter's Agency that an enormous stock of commodities of all descriptions has been prepared by German manufacturers, which it is their great endeavour to turn into cash at the earliest possible moment by any means that they can discover; and the Germans are showing no scruples in the pursuit of their end. One of the practices employed is to counterfeit all sorts o trade marks, especially of commodities manufactured by firms o high repute in neutral or allied countries; and by this means the have already obtained opportunities of sending their goods in considerable quantities throughout the world. Switzerland and othe neutral countries are naturally open doors to the whole world. I would seem to be the duty of the Allies to prevent German realizing its assets in this fraudulent manner. The irony is tha neutrals not only sell to other neutrals and our Colonies, but sen over German goods which are being sold in this country disguise under counterfeit trade marks. It is evident a commercial an industrial war will be waged by our enemies with the same ruthlessness and neglect of all scruples as we know from bitter experience characterize their military operations, which are a disgrac to civilization.

Dr. J. A. Fleming, in a recent lecture at University College London, on "Science in the War, and after the War," points ou that we must say "Good-bye" now and for ever to those eas going British methods which have held us in the past. What w equire is to obtain a higher degree of efficiency in all our operaions. For years we have been buying dyes, drugs, chemicals, lass, optical instruments, machinery, and hundreds of other nanufactured articles from Germany and Austria. We have no ieed to buy, but simply because we shirked the effort and new nethods necesary to make them as cheaply and as well at home. n many instances, we actually exported the necessary crude prolucts for their manufacture, and re-purchased finished goods.

It seems to me that the Society of British Gas Industries might ssist materially in these matters that concern the many manuacturers it represents, and perhaps take some definite action.

DISCUSSION.

Mr. H. James Yates proposed a vote of thanks to Mr. Milbourne or his paper. The warning as to the matter that he had introluced came none too soon. The Britisher was now waking-up o the fact of what Germany was doing by most unscrupulous nethods, and proposed to do after the war was over.

Mr. F. G. Cockey seconded the motion with much pleasure.

The Chairman said he was certain that the more the members hought over this matter, the more importance they would attach o it. They knew that at the present time there were goods used n connection with the gas industry which were being imported nto England in very large quantities, and which were German r Austrian make. The matter had been under discussion by the Council for a long time; and they were not going to let it rest vhere it was. They knew that hundreds of thousands of mantles vere brought into England, marked "Made in Holland," or British Made." Under the British mark on some goods, one ften found in small letters "Made in Germany" or "Made in ustria." This was so with a large quantity of glassware that vas coming over here. These goods were not all being put on he market at the present time; and when the war was over, their nemies would be in the position to glut the market with them. A ot of goods were now being manufactured for the purpose of apturing British trade when the time came. The question was lso an important one to British Colonies and neutral countries, specially foreign-made articles that bore the British trade mark. or instance, for years "Sheffield Made" had been put on large uantities of German-made razors that had been exported to oreign countries and the colonies. This, he believed, was still oing on. This country did not take the measures that it ought o do to counteract this sort of thing. Mr. Yates reminded him hat they had evidence before them of gas undertakings that were t the present time importing foreign glass, and using it because hey said they could not procure it in this country.

The motion for the vote of thanks was heartily agreed to.

Mr. F. J. West thought that the subject brought forward by Ir. Milbourne was one deserving considerable attention from he Society. He was pleased to hear the Council had the matter nder consideration. It was recently his privilege in the Manhester City Council to second a resolution to the effect that no ontracts would be placed in future with German firms, and no ontracts would be placed in this country where the proportion of erman capital in the business was beyond a certain figure. This esolution was unanimously carried. In the discussion on that ccasion, mention was made of the clever way in which the Gernans introduced their specialities in this country under the guise f a British combine; while an examination of the shareholders' st generally revealed the fact that five-sixths of the capital came om Germany, and only probably one-sixth was British. It had een demonstrated time after time how dependent this country ad become upon Germany for certain products, and what a long me it had taken for this country to recognize the fact, and to get nto line, and put its house in order. He suggested that the Counil should at the earliest opportunity approach the Institution f Gas Engineers, and ask them to revise the standard contract lauses, for the purpose of preventing German and Austrian goods eing used in future. This matter was one that rested very much ith the buyers; and unless British manufacturers had the symathy of buyers in this matter, he was afraid that they would not et much further. In addition to revising the standard contract lauses, he thought it should be possible to draw up some heads f agreement with regard to dealing with concerns where German apital existed. Also some effort might be made to establish an ivestigation into these trade marks to prevent the market being ooded with German articles under the name of "British."

Mr. Thomas Glover (London) said if this matter was taken up the way suggested by Mr. West, it occurred to him that it was ot only a question of dealing with it under the standard clauses, ut it was also one that could be judiciously mentioned to the British Commercial Gas Association, because it was common nowledge to everybody present that many of the most promient members of the British Commercial Gas Association were xactly those who had been referred to as buying German lamps, nantles, and glass.

The Chairman remarked that the Secretary reminded him his matter was taken up some little time ago by the British Empire League; and a big meeting was held at the Queen's Hall, nder the presidency of the late Duke of Argyll. The Secretary ttended it. An Association was formed, called the British Empire Trade Mark Association; and they got very influential upport. The idea was that all goods made in this country or in he colonies should bear the mark showing origin in the British Empire. The Board of Trade, however, refused to register the British Empire trade mark. So the matter fell through.

Mr. W. D. Helps said in regard to the remarks made by Mr. West as to some gas undertakings encouraging German and other foreign-made goods, in fairness it should be said that there were by no means unimportant gas undertakings that were shutting the door against foreign goods, and even goods that had doubtful origin. These gas undertakings were stronger in their resolve to-day than twelve months ago not to buy German or Austrian made goods. He had two or three especially in mind. He had twitted the managers on the subject, and had suggested that, within three months from the time the war was over, they would be again buyers of goods from abroad. But the managers said that they would not, and their directors were heartily supporting them in their resolve. They wanted more gas undertakings of this character, and doing the same thing.

Mr. Milbourne said he was extremely obliged to the members for the vote of thanks which had been so cordially passed for the paper. He was sure that most of the members thought it was quite impossible to take an optimistic view of the present position of affairs. They had got to look at the business side of the country after the war was over. The suggestion that Mr. West made was a good one; and he thought the matter might be commended to the Council of the Society. It must be remembered that France had already established a very powerful Committee; and they were laying the foundation-stone now for a definite policy in the great economic struggle which must take place at the conclusion of the war. They did, he believed, as business men recognize the fact that most of them were working now under different conditions from what they generally did. Most of the members of the heavy section were now engaged on munitions work; and as soon as the war ceased, all this would suddenly stop, and it would be very difficult to find the necessary trade to keep many of the large works going. They had to recognize, too, that as soon as peace was declared, they had to be prepared to resist the German commercial invasion which, he felt convinced, would take place, unless some action were started in the matter.

The Yates Golf Cup.

The Chairman then presented the Yates Golf Cup to the winner—Mr. Charles S. Bennett, of Gibbons Bros., Limited, and B. Gibbons, jun., Limited.

Vote of Thanks to the Chairman.

Moved by Mr. Broadhead, and seconded by Mr. Cyril G. Davis, a hearty vote of thanks was accorded to the Chairman for presiding and for his hospitality in inviting the members to take tea together.

The Chairman, in replying, observed that it was a great pleasure to him to be of service to the gas industry at any time.

The members were the Chairman's guests at tea, which was served in the adjoining room. This gave a little time for social intercourse before separating.

London and Southern District Junior Gas Association.—At a meeting of the Association on Friday evening next, Mr. H. Hartley, of the Richmond Gas Stove and Meter Company, Limited, will give a lecture, illustrated by lantern slides, entitled the "Development of Gas-Fires, 1913-15."

Institution of Water Engineers.—The twentieth annual winter meeting will be held at the Geological Society's apartments, Burlington House, W., on Friday, the 10th prox., commencing at 2.30 p.m. A discussion will be invited on "The Necessity for Defining the Term 'Domestic Purposes' in General and Private Water Acts." The election of the President and Council for the year 1916-17, also the election of the Auditors for the year 1916, will take place at this meeting.

Export Licence Application Forms.—The attention of exporters of coal and gas coke is, says the "Times," specially directed to the announcement issued by the War Trade Department on Oct. 14, in which it was intimated that, on and after Nov. 1, it would be necessary for a revised form of application for a licence to be used. As applications are still being made on the old form, it is advisable to warn exporters that applications cannot be considered by the Coal Exports Committee unless the new form (dark blue) containing a declaration that the proposed shipment is in pursuance of an existing contract or in execution of a definite order, is used. Any applications received on the old form must therefore be returned. The new forms are obtainable at the Custom House at coal ports.

Certification of Cement for Export.—The Imperial Institute notify that a laboratory for testing cement has now been added to the establishment of the Scientific and Technical Research Department of the Institute. In certain countries, such as Argentina, the national Government have adopted an official specification for cement to which all cement intended for use in the construction of public works must conform. The Argentine Government also require the certification of such cement by a laboratory recognized for the purpose by the Government of the exporting country. H.M. Government have now recognized for this purpose the cement-testing laboratory of the Imperial Institute, at which analyses and tests will in future be conducted for British-made cement for contractors, engineers, manufacturers, and others desiring to export cement to the Argentine and other countries where a Government certificate is required. Firms requiring such assistance should communicate with the Director of the Imperial Institute, South Kensington, S.W.

GAS AS A CASE-HARDENING AGENT.

By Alfred H. White and Homer T. Hood.

[A Paper submitted at the Twenty-fourth Annual Meeting of the Michigan Gas Association, Detroit, Sept. 24.]

Introduction.

It has been known for several centuries that it was possible to form a hard steel skin upon mild-steel articles by embedding them for a number of hours in charcoal maintained at a red heat. Within recent years scientific investigation has shown that it is not the solid carbon which exerts the most powerful carbonizing action, but that it is the gaseous carbon monoxide formed through the action of air enclosed in the spaces between the carbon grains or evolved from materials added, which effects the case-hardening. The most comprehensive studies have been made by Giolitti,* who has issued a book on the subject which has been recently translated into English. He strongly favours carbon monoxide as a carburizing agent, and states that hydrocarbons in high concentration are objectionable.

Illuminating gas has been used for some years commercially as a case-hardening agent in this country, with excellent results in the hands of some operators, and with perhaps indifferent success in the hands of others. The case-hardening of steel is an important industry, and is usually carried out in cities of sufficient size to have gas plants; so that the study of the advantages and limitations of illuminating gas as a case-hardening agent is of material importance to the gas and metallurgical industries.

The results of these tests show that it is possible to produce excellent results and almost any type of case-hardening with unenriched coal gas. There is no reason to doubt that any of the usual types of city gas will accomplish the same result, and that the method is capable of wide and advantageous commercial applications.

In the following argument there will be a brief review of the general processes of carburization, followed by a more specific discussion of the methods to be used in carburizing with gas.

General Processes of Case-Hardening.

The purpose of case-hardening is to manufacture steel objects with a hard, resistant surface over a soft, tough centre or core. The objects are first machined out of plain carbon or alloy steel, containing generally less than 0·25 per cent. of carbon, which is soft and tough and easily machined. The surface of the objects is then carburized—*i.e.*, the surface is changed from a low-carbon steel to high-carbon steel, which will harden on heat treatment and produce an object with a hard, wear-resisting surface and a tough, ductile core, so that the object can not be easily broken. The carburizing is accomplished by exposing the steel at a high temperature to the action of a carburizing agent. The carburizing agent which is the source of available carbon may be a solid such as charcoal, bone, or leather scrap, with mineral matter such as barium carbonate frequently added, a liquid such as molten cyanides, or gas such as illuminating gas, carbon monoxide, or oil gas. There are five factors governing the process of carburizing:

1. The composition of the steel.
2. The nature of the carburizing agent.
3. The temperature of carburizing.
4. The concentration of the carburizing agent and the intimacy of its contact with the steel.
5. The duration of carburizing.

The quality of the finished piece depends also on the nature of the subsequent treatment. In order to produce a hard surface, the pieces must be quenched from above their critical temperature; but if the steel is quenched directly from the carburizing heat it will be brittle, and the structure of case and core will be coarse and weak unless the temperature of carburizing has been kept very low, or unless the raw material contains one of the alloying elements which retard grain growth. If the carburized steel is allowed to cool, and is reheated to a temperature only high enough to refine the grain of the high carbon case, and is then quenched from this temperature, the grain of the carburized zone will be very fine, but that of the core will still remain as coarse as at the end of the carburizing operation. In this condition the line of demarcation between case and core is very sharp.

In order to get the toughest possible steel, the piece must be cooled from the carburizing temperature in such a way as to avoid oxidation as much as possible. It is advisable to cool slowly in the boxes; but if the pieces are of such a size and shape that they can to advantage be removed from the carburizing while hot, they may be quenched at this state. The steel should then be reheated just above the refining temperature of the low-carbon core and quenched in oil or warm water. This gives a fine grain to the core, but leaves the surface with somewhat coarse grain. The piece should then be reheated to a temperature just above the critical temperature of the high-carbon surface and quenched in water. It will then have a very hard surface with the finest possible grain. Generally the surface will be harder than necessary; but by reheating to a temperature below the critical temperature, it is possible to draw the temper, reduce the hardness, and at the same time greatly toughen the piece, while also reducing its brittleness.

[Each of the five factors governing the carburization process is then considered separately in the light of the literature on the subject. A list of the references cited is given by the authors at the close of the paper.]

Composition of the Steel.

The influence of the composition of the steel on the case-hardening process is discussed by many authorities, who agree that the absorption of carbon is favoured by those special elements which exist as double carbides, such as manganese, tungsten, chromium, and molybdenum, and is opposed by those which form solid solutions with iron, such as nickel, silicon, and aluminium. Nickel, while it appears to decrease the percentage of carbon in the case, seems to increase the rate of penetration. Manganese should not be above 0·25 per cent., or else the case will be brittle. Carbon is more rapidly absorbed by low-carbon steels; but if they are used, more carbon must be taken up in order to get the desired percentage. Therefore time is saved by using a medium-carbon steel rather than a low-carbon steel. For general case-hardening, the steel should be tough and show a high elongation, but yet should machine easily. A popular steel for this purpose contains from 0·15 to 0·25 per cent. of carbon and not more than 0·04 per cent. of sulphur and phosphorus. Another very tough steel, and one very resistent to elastic fatigue, contains carbon up to 0·25 per cent., and, in addition to the regular elements, nickel of about 1·25 to 1·50 per cent. and chromium of 0·5 to 0·6 per cent. Either the carbon steel or this low chrome steel will carburize readily by any of the standard methods.

Nature of the Carburizing Agent.

Carburizers may be solid, liquid, or gaseous. Liquid carburizers are the molten cyanides or ferrocyanides, and are used only when a very thin superficial case is desired. Small pieces of metal will be carburized to a depth of 0·001 to 0·003 inch after only a few minutes' immersion in the molten bath. A deep case may be obtained by a long immersion in the bath; but it is generally agreed that the use of a solid carburizing agent is preferable when a deep case is desired. The cyanide is also very poisonous, and is potentially dangerous for the workmen. The solid carburizers have as their essential agent solid carbon. All of them generate a carburizing gas at the temperature of carburizing; and it is this gas, and not the solid carbon, which is the effective carburizing agent. It has been shown that in the absence of gases (as in a vacuum) solid carbon only carburizes when it is pressed firmly against the iron or steel, and that then its action is too slow to be of commercial use.

The solid carburizers may be divided into two groups: 1, Those, such as charcoal alone, or charcoal with barium carbonate, which carburize almost exclusively by the specific action of carbon monoxide; and 2, those, such as bone, hide scraps, or ferrocyanide mixtures which carburize partly through the action of cyanides in addition to the action of carbon monoxide. Those of the second group do not seem to carburize more rapidly than those of the first, but lose their effectiveness much more quickly and are rather more expensive. A mixture of charcoal with 10 to 40 per cent. of barium carbonate seems to be about the best and most satisfactory of the solid carburizers. The barium carbonate slowly decomposes at the carburizing temperature—yielding barium oxide and carbon dioxide. The latter is reduced by the charcoal to carbon monoxide, and the barium oxide on exposure to air at ordinary temperature is changed back to the carbonate:

$$\left.\begin{array}{l} BaCO_3 \rightarrow BaO + CO_2 \\ CO_2 + C \rightarrow 2\,CO \end{array}\right\} \text{at carburizing temperature.}$$

$$BaO + CO_2 \rightarrow BaCO_3 \qquad \text{at ordinary temperature.}$$

Calcium carbonate and ammonium carbonate break-up too easily, and the alkali carbonates too slowly, to be as good reagents as the barium carbonate.

The nature of the gases evolved on heating some of these solid carburizers is shown in Table I., taken from the work of De Nolly

Table I.—*Composition of Gases Evolved on Heating Solid Carburizers.*

Composition of Carburizers.

No. 1	Wood charcoal.
No. 2 90 per cent.	Wood charcoal *plus* 10 per cent. barium carbonate.
No. 3 70 per cent.	Wood charcoal *plus* 30 per cent. barium carbonate.
No. 5	Wood charcoal previously ignited at 1800° Fahr.
No. 7 20 per cent.	soot *plus* 40 per cent. gypsum, 40 per cent. potassium ferro-cyanide.
No. 9 20 per cent.	animal refuse (hoof, hide, bone, &c.), 50 per cent. plant matter, 11 per cent. soda, 5 per cent. silica brick, 14 per cent. moisture.

Analysis of Gases Evolved.

Sample No.		1	2	3	5	7	9
1560° F.	CO	11·3	28·1	25·3	42·2	29·4	54·4
	H_2	74·0	52·8	57·7	20·0	23·6	34·8
	CH_4	10·0	8·7	8·7	2·0	1·2	1·7
1920° F.	CO	19·6	37·3	56·1	71·7	55·6	36·8
	H_2	73·5	60·0	32·0	15·0	19·2	51·4
	CH_4	0·6	0·9	0·9	0·7	0·9	1·2

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* "The Cementation of Iron and Steel"—a book in which Giolitti reviews all his previous articles on cementation. Probably the best book written which treats of the subject from the scientific standpoint.

d Veyret. It will be evident that at the higher temperatures e gases are composed almost wholly of hydrogen and carbon onoxide. Nos. 7 and 9 carburized well when fresh, but lost eir effectiveness very quickly. Nos. 2 and 3 carburized as pidly, held their effectiveness longer than the others, and emed to be the most satisfactory. It is well known that the ectiveness of solid carburizers is usually diminished after veral heatings. When first used there is still some destructive tillation with evolution of hydrocarbons, as shown in Nos. 1, 2, d 3. After the material has been once heated, as shown in . 5, the amount of hydrocarbon decreases, and the material sumes more nearly the properties of carbon with added mineral tter.

GASEOUS CARBURIZERS.

The solid carburizers are to be considered merely as agents for erating a carburizing gas whose active constituent is mainly bon monoxide. Thus the specific action of carbon monoxide atly preponderates over that of other agents when solid car-rizers are used. The solid carburizer is, therefore, unnecessary, ce the gases may be generated entirely independently and n be conducted into the furnace. There are various advant-s in this procedure. The solid carburizers in the carburizing xes may depreciate or change in composition and action; but the use of a gaseous carburizer a carburizing agent of uniform ality is assured. We may thus not only maintain a constant nposition of the carburizing gas, but we can heat all the pieces the furnace up to the carburizing temperature before admitting carburizing gas, and thus carburize all pieces to the same oth. There are three types of gaseous carburizers: 1, Carbon noxide; 2, hydrocarbons; 3, cyanogen and various volatile anic compounds containing carbon and nitrogen.

arbon monoxide when used alone gives a case which is low in bon. At 1475° Fahr., the case contains 0·80 to 0·90 per cent. bon; but at this temperature the rate of carburization and etration is very slow. At 2000° it gives only 0·20 to 0·30 per t. of carbon to the steel, but its rate of penetration is very id. Thus carbon monoxide alone is a poor carburizing agent. moderately high temperatures carbon monoxide decomposes tially to form carbon dioxide and free carbon, which free bon formed combines with the iron. As the temperature in-ases, the amount of decomposition of carbon monoxide into e carbon and carbon dioxide decreases. However, the rate of usion of carbon and also of carbon monoxide into steel in-ases when the temperature increases; so that it is quite natural t the percentage of carbon in the case should be lower as the perature gets higher. In the presence of excess carbon, which y be provided by means of a solid carburizer, or by means of ydrocarbon, the action of carbon monoxide becomes much re satisfactory; and by their combined action, a high carbon e may be obtained at high temperature.

he hydrocarbons are much stronger carburizers than carbon noxide; and, if allowed sufficient time, they will produce a case y high in carbon. At high temperatures the hydrocarbons de-npose—giving as ultimate products of their decomposition bon and hydrogen. Of the hydrocarbons, methane is the most ble. It is practically unchanged when heated to 1600° Fahr.; even at 1900° the decomposition is slight, unless accelerated contact with a porous solid surface. The other hydrocarbons much less stable than methane. They decompose slowly at ut 1500° Fahr., but quite rapidly above 1700° Fahr., and do require the presence of a contact-surface for their decom-ition. At relatively low temperatures a large proportion of ir decomposition product is methane; but at higher tempera-s they decompose directly into carbon and hydrogen. The rocarbons when dissociated deposit carbon on the iron in the n of a scale. This carbon is probably the means by which e hydrocarbons carburize the steel. The carbon from the rocarbons other than methane is in the form of soot, and n deposited on the surface of a piece is in intimate contact the iron, and consequently is a very active and rapid car-izing agent. When methane is used, part of it decomposes at surface of the iron, and leaves a very hard compact scale like rt carbon; but the other part penetrates into the steel until eventually decomposed. Methane is thus more effective than other hydrocarbons. A larger portion of the carbon of hane gets into the steel than of the other hydrocarbons, but ts slowly below 1700° Fahr. On the whole, the hydrocarbons energetic in their action, and produce a case which is high in on and which increases in carbon content as the temperature arburizing increases. When pure hydrocarbons are used, the tends to be too high in carbon and to have too sharp a ndary; and more satisfactory results are attained if they are ted so that they do not give a case with so high a carbon con-. It has been noted that carbon monoxide gives a case too in carbon, and that it works better when enriched with a e active carburizer. Thus a mixture of carbon monoxide and rocarbon gives the best results.

yanogen carburizes very energetically, but gives a case which igh in carbon with an abrupt change between the carburized and the central core which is not carburized. The case is one which is easily split off, and is not desirable commer-y. Free nitrogen has no effect except to dilute the carburizer make its action slower. Combined nitrogen, as in ammonia, bines with the iron or steel to give a nitride of iron, which is hard and exceedingly brittle. Consequently, such nitrogen compounds are objectionable. Cyanogen is dangerous because of its extremely poisonous nature, and organic compounds containing nitrogen are somewhat expensive. It has been recommended to enrich the carburizer, either solid or gaseous, with sal ammoniac, ammonium carbonate, or other ammonium salt, in the belief that the ammonia aided in the carburization, probably through the formation of cyanogen. It has been shown quite conclusively that the ammonia does not form cyanogen, and that it does not help the absorption of carbon. It does make the steel harder through the formation of a nitride of iron; but it is undesirable because of the brittleness of the nitride, as explained above.

ILLUMINATING GAS AS A CASE-HARDENING AGENT.

Commercial illuminating gas consists of a mixture of hydrogen and methane, with smaller amounts of other hydrocarbons, carbon monoxide, and carbon dioxide. It might be thought that coal gas which has been formed in a retort at a bright red heat would not suffer further change at the temperature of the carburizing retort; but such is not the case. The coal gas escapes so rapidly from its retort in the manufacturing process that it never becomes fully heated to the retort temperature; and when introduced later in a slow stream into the carburizing retort it breaks down—the hydrocarbons changing to free carbon and hydrogen, and the carbon dioxide and water vapour present reacting to form carbon monoxide and hydrogen. Any coal gas or carburetted water gas will be a strong carburizing agent.

Kurek has given the results of a number of tests on the case-hardening of a mild steel by illuminating gas. His steel contained 0·09 per cent. of carbon and 0·32 per cent. of manganese; and the gas had the following composition:—

	Per Cent.
Carbon dioxide	1·7
Heavy hydrocarbons	2·8
Oxygen	0 3
Carbon monoxide	9·7
Hydrogen	51·7
Methane	30·7
Nitrogen	3·3

He determined the extent to which the carbon had penetrated by removing successive layers of 0·2 mm. each (0·008 inch) and analyzing each layer for its carbon content. His results with illuminating gas, methane, and carbon monoxide are given in Table II.

TABLE II.—*Results of Case-Hardening with Various Gases, according to Kurek.*

CARBON MONOXIDE.

Analyses taken from successive layers 0·2 mm. thick.

Temp.	Time.	Percentage of Carbon in Layer No.			
		1.	2.	3.	4.
1475° Fahr. .	8 hours	0·67	0·32	0·28	0·21
1650° ,, .	4 ,,	0·55	0·36	0·27	0·25
1830° ,, .	4 ,,	0·41	0·31	0·21	0·18
1830° ,, .	8 ,,	0·46	0·36	0·36	0·29
2000° ,, .	8 ,,	0·28	0·28	0·28	9·22
1300° ,,	4 ,,	0·15	..	..	..
1100° ,, .	4 ,,	0·13	..	..	..
		METHANE.			
1475° ,, .	4 hours	No carb	urizing	..	..
1650° ,, .	4 ,,	1·31	0·93	0·74	0 45
1830° ,, .	4 ,,	1·81	1·41	1·26	0·55
		ILLUMINATING GAS.			
1475° ,, .	4 hours	0·93	0·35	0·16	0·13
1650° ,, .	4 ,,	1·45	1·10	0·79	0·48
1830° ,, .	4 ,,	2·18	1·37	1·19	0 95

The rate at which illuminating gas is conducted through the apparatus affects the carburizing. The hydrocarbons are decomposed gradually, and deposit carbon either as a loose soot or a hard scale on the pieces. The hydrocarbons act mainly at the surface, and by means of this carbon deposit. Therefore, to get the maximum rate, there should be a coating of carbon on the surface. As has already been mentioned, carbon monoxide acts most strongly when there is some free carbon present; and, for this reason also, there should be a light carbon deposit on the metal. It should, however, be a thin coat, if the gases are to have a strong direct action; for if there is a heavy carbon deposit, the gases will be partially excluded, and if there is no carbon deposit it indicates either that the hydrocarbons have been decomposed before they have come in contact with the steel or that the carbon is not being deposited on the steel as rapidly as it is being absorbed. A practical operating rule would, therefore, be to run the gas into the carburizing chamber at such a rate that there will be a light deposit of carbon on the iron being carburized.

Carbon diffuses into steel very slowly, if at all, below the critical temperature of the steel. Above the critical temperature, the diffusion increases quite rapidly as the temperature increases. All the carburizers except carbon monoxide produce a greater percentage of carbon in the carburized zone as the temperature increases. The following table showing the effect of temperature is taken from Robin's work. It shows a percentage of carbon at the given depth after carburizing for seven hours in coal gas at the stated temperatures. The original steel contained 0·03 per cent. of carbon.

TABLE III.—*Results of Carburizing Low Carbon Steel for Seven Hours in Illuminating Gas at Various Temperatures, According to Robin.*

Temp.	Percentage of Carbon at Depth of				
	1 mm.	2 mm.	3 mm.	4 mm.	5 mm.
1112° Fahr.	0·051	0 032	..	..	..
1292° ,, . . .	0·096	0·045	0·036	..	..
1472° ,, . . .	0·21	0·105	0·048	..	..
1652° ,, . . .	0·363	0·21	0·057	0·03	..
1742° ,, . . .	0·451	0·219	0·093	0·049	..
1832° ,, . . .	0·579	0·321	0·241	0·152	0·091
1922° ,, . . .	0·594	0·365	0·322	0·212	0·15
2012° ,, . . .	1·522	1·487	1·284	1 147	0·988
2102° ,, . . .	1·637	1·604	1·382	1·330	1·195
2192° ,, . . .	2·364	1·708	1·488	1·437	1·349

The figures in the first column up to 2012° may seem rather low; but it is to be noted that this analysis is not at the surface but at a depth of 1 mm. from the surface. The original steel contained only 0·03 per cent. of carbon, and not about 0·20 per cent. as is generally used for case-hardening.

The concentration of a carburizer may be defined as the quantity acting on each surface unit of the metal in unit time. The concentration of a gaseous carburizing agent may be changed by diluting it with an inactive gas or by changing the gaseous pressure. It is not generally desirable to dilute the carburizers, as this simply makes carburizing slower; but it would sometimes be desirable to increase the rate of carburizing by concentrating the carburizers—*i.e.*, by using them under pressure. Carbon monoxide responds quite appreciably to increase in pressure, but the other gaseous carburizers do not. This can be explained as follows: The equilibrium of chemical reactions tends to change, so that a reaction will tend to relieve the conditions which produce the change. If the pressure is increased, the reaction will tend to proceed in such a direction as will tend to relieve the pressure—that is, in such a direction as will cause a decrease in volume.

$$\begin{array}{lcl} 2\,CO & \longrightarrow & CO_2 + C \\ 2\ \text{Vol.} & & 1\ \text{Vol.} \\ CH_4 & \longrightarrow & C + 2H_2 \\ 1\ \text{Vol.} & & 2\ \text{Vol.} \\ C_2H_6 & \longrightarrow & 2\,C + 3H_2 \\ 1\ \text{Vol.} & & 3\ \text{Vol.} \end{array}$$

A glance at these equations will show that the decomposition of carbon monoxide into carbon dioxide reduces the volume to one-half the original; while in the other two reactions, the decomposition which will produce carbon causes an increase in volume. Consequently the carbon monoxide will carburize faster under high than under low pressure. At 0·6 atmosphere the hydrocarbons carburize a very little slower than at atmospheric pressure; while carbon monoxide carburizes only about 0·7 time as fast.

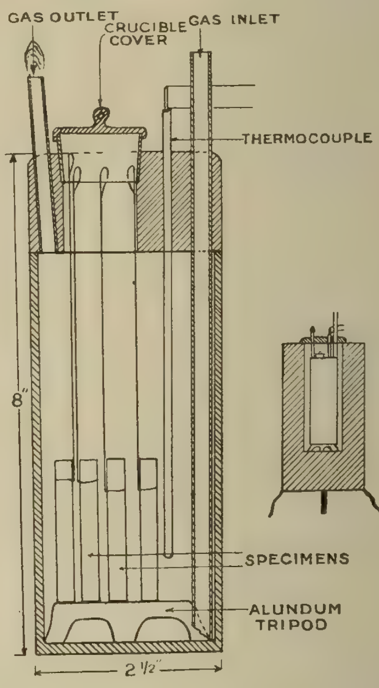
The depth of carburization increases with its duration; and for about two hours the rate of penetration is nearly proportional to the duration. But as the time becomes longer, the rate of penetration becomes slower. This is due to the fact that the carburizers introduce carbon into the surface layers faster than diffusion carries the carbide of iron into the iron. Thus the layers of the surface will be carburized rapidly by the direct action of the carburizer, while the deeper layers will be carburized mainly by the diffusion of carbon or carbide through the steel. Illuminating gas at about 1750° Fahr. will give a case 1-32nd inch in thickness in three hours.

EXPERIMENTAL WORK.

There is some disagreement among the authorities previously cited as to the value of illuminating gas as a case-hardening agent, and the conditions under which it should be used; so experiments were conducted on the laboratory scale (with as much care as possible) to add further data for discussion.

The construction of the laboratory carburizing furnace is shown in the illustration. An unglazed porcelain cup formed the body of the muffle. The top was built up out of alundum cement, with the inlet, outlet, and thermocouple tubes inserted. The upper part of a porcelain crucible was sawn off and inserted to form the charging hole; and the crucible cover was used as the cover. In the bottom of the muffle was placed an alundum table. The specimens, which were about ⅜ inch square and 2½ inches long, were lowered into the muffle on wires, and stood on end on the table so that the gas was spread out and diffused evenly in the lower part of the furnace, and all pieces were exposed on all four sides to the same quality of gas and at the same temperature. The muffle was placed within a vertical electric muffle furnace. It could be heated very evenly, and could be kept within 5° of any desired temperature for a long time. In commencing a test, the furnace was heated about 75° higher than the desired temperature. The current was then reduced to such a value as would just maintain the furnace at the desired temperature and the specimens were put in. The excess heat in the furnace counterbalanced the cooling effect; and the furnace and contents could in this way be brought to the desired temperature in about 15 minutes. After being carburized for the proper length of time, the specimens were lifted out of the furnace by means of the wires attached, and were buried in charcoal, where they were allowed to cool. The charcoal was used to prevent the pieces from being decarburized by the oxygen of the air. The wires used for supports for lifting out of the muffle were, after carburizing, so hard that considerable force was required to bend them. Their hardness was similar to that of piano wire; but they were much more easily broken. In the test where the ammonia was used, the wires were not as strong—only a slight force was required to bend them, and but a very slight deflection was required to break them. The gas used for carbonizing was an unenriched coal gas with a heating value of 600 to 620 B.Th.U. per cubic foot. The gas was passed in at such a rate as to barely maintain a *plus* pressure in the muffle.

By running several different steels at the same time, the effect of the composition of the metal could be determined. By running pieces of steel from the same bar for the same length of time, but at different temperatures, the influence of temperature could be determined. By running pieces of steel of the same composition for the same length of time and at the same temperature, but with a different quality of composition of gas, the effect of the composition of the gas could be found. The results agreed well among themselves, and confirmed the results of previous workers who found illuminating gas a desirable carbonizing agent. The change in composition of the carburized pieces was determined by the usual microscopic methods.



Laboratory Furnace for Case-Hardening Steel with Illuminating Gas.

TABLE IV.—*Composition of Steels Used in Case-Hardening Tests.*

	Mild Steel.	Machine Steel.	Nickel Chrome Steel.
	Per cent.	Per cent.	Per cent.
Carbon	0·04	0·22	0·354
Manganese . . .	0·10	0·44	0·486
Phosphorus . . .	0·007	0·011	0·012
Sulphur	0·029	0·031	0·022
		Silicon . .	0·169
		Nickel. .	1·50
		Chromium.	0·57

The composition of the steels used is shown in Table IV. Tests were run at 1650°, 1740°, 1830°, and 1920° Fahr. with pure coal gas, and at 1650° with coal gas containing about 6 per cent. of gaseous ammonia. One series of tests was run with a uniform carburizing period of three hours. Since a three-hour treatment at 1850° to 1950° gives a case which is higher in carbon and also rather deeper than is usually required, three more tests were run of shorter duration. One set of pieces was kept exactly an hour in the furnace with carburizing gas on during the whole run, and the temperature ranging from 1830° at the end of ten minutes to 1740° at the end of the hour. The other two were both of one hour and ten minutes duration, and the temperature ranged from 1900° at the end of ten minutes to 1975° at the end of the run. The carburizing gas was turned on at the end of ten minutes, and turned off at the end of forty minutes. Thus the carburizing gas was on thirty minutes, and then the piece was allowed to soak thirty minutes at the high temperature—thus giving the high carbon near the surface an opportunity to diffuse deeper into the piece.

After the test-pieces had been cooled in charcoal, a portion was sawn off for microscopic examination, and the remaining portion subjected to the double-heat treatment usually given case-hardened work. The pieces were placed in the furnace already heated to 1650° Fahr., which is a somewhat higher temperature than is necessary for 0·22 per cent. carbon steel, but was adopted since pieces of the 0·04 per cent. carbon steel were treated at the same time as the set with higher carbon. The purpose f this heating is to refine the grain of the core; and its duration hould be short, and the subsequent cooling fairly rapid, to revent the crystals from again growing large at the high tem- erature. The test-pieces, on account of their small dimensions, tained the temperature of the furnace in about fifteen minutes. hey were then quenched in oil, reheated to 1475° Fahr., and enched in water to harden the pieces.

Results of Experimental Work in Case-Hardening with Coal Gas.

The experimental work showed that practically any desired pe of case could be readily obtained. The results of a number different tests made at various temperatures and with differing nditions are given in Table V. [They were also shown in part a series of photomicrographs.]

Table V.—*Results of Carburization in Coal Gas.*

Designation	Total.	Depth of Case in Inches.			Hardness after quenching Brinnell Number.
		Less than 0·85 per cent. C.	0·85-0·90 per cent. C.	Greater than 0·90 per cent. C.	
Carburized for Three Hours at 1650° Fahr.					
4 per cent. C.	0 024	0·014	0·010	—	285
2 per cent. C.	0·028	0·012	0·016	—	444
Cr.	0·030	0·010	0·020	—	555
Carburized for Three Hours at 1740° Fahr.					
2 per cent. C.	0·035	0·016	0·015	0·003	555
2 per cent. C.*	0·032	0·023	0·012	0·000	555
Cr.	0·040	0·016	0·024	0·000	601
Carburized for Three Hours at 1830° Fahr.					
2 per cent. C.	0·048	0·014	0·012	0·012	601
Cr.	0·072	0·020	0·052	—	653
Carburized for Three Hours at 1920° Fahr.					
4 per cent. C.	0·055	0·016	0·014	0·025	601
2 per cent. C.	0·084	0·033	0·020	0·031	627
Cr.	0·092	0·023	0·052	0·017	601
rburized for Three Hours at 1650° Fahr., with Coal Gas Plus 6 per cent. Ammonia.					
4 per cent. C.	0·030	0·026	doubtful composition because of nitride of iron		321
2 per cent. C.	0·030	0·024			477
Cr.	0·028	—			601
rburized for Thirty Minutes at 1900° to 1975° in Coal Gas and then Allowed to Soak Thirty Minutes.					
4 per cent. C.	0·030	0 01	0·02	—	—
2 per cent. C.	0·045	0·02	0·025	—	—
Carburized for One Hour at 1830° to 1740° in Coal Gas.					
2 per cent. C.	0·02	0·01	0·01	—	—

* Protected by a wrapping of asbestos.

he steel used in the last of these was chrome-nickel steel, and as carburized three hours at 1650° Fahr. in an atmosphere of l gas to which had been added about 6 per cent. of gaseous monia. The chrome-nickel steel carburizes very much as the in carbon steel. The added ammonia, however, caused the mation of a nitride of iron, which appeared as a rather granular ite constituent on the edge of the piece. The addition of am- nia or ammonium compounds to carburizing agents has been ocated on the ground that a hard case is more rapidly attained their aid. This practice is, however, objectionable, for the ide of iron, although hard, is very brittle. This was shown by properties of the wires which were left attached to the test- ces while they were being carburized. The wire which was ched to the specimen carburized in gas with added ammonia scarcely stronger than a straw, while in the experiments re gas alone was used, these wires possessed a strength and dness similar to an ordinary cambric needle.

Rapid Carburizing with Gas.

t has already been pointed out that not only does the rate of burizing increase rapidly with the temperature, but that the centage of carbon in the case increases also. Too high a per- tage of carbon is objectionable; and Giolitti's objection to minating gas as a carburizing agent is largely based upon this culty. If the skin is too high in carbon, and there is not a dual gradation in carbon content from the outside to the inside he case, there may be such a difference of expansion that, in eme cases, the case-hardened skin may split off on quenching. litti therefore prefers, as a case-hardening agent, carbón mon- le which works more slowly and uniformly. A modification he treatment with illuminating gas which is here described , however, remedied the difficulties usually experienced in the mpt to use illuminating gas at high temperatures.

he procedure adopted was to place the test-pieces in the retort carburize with coal gas for a short time at a high tempera- —thus producing a thin case high in carbon. The carburizing was then shut off and the steel left to soak in the hot retort l the absorbed carbon had diffused itself through a wider area the case was of the quality desired. It required ten minutes ring the specimens to the furnace temperature. The coal gas carburizing was then passed slowly in for thirty minutes and turned off; the pieces remaining in the furnace for yet another thirty minutes to allow diffusion of the carbon toward the centre of the piece. Neither of these pieces showed the high carbon hyper-eutectoid layer which has been an objectionable feature of all attempts to accelerate case-hardening by the use of hydrocarbons at high temperatures.

Summary.

As soon as it was shown that the action of solid carburizers was due primarily to gases which they evolved, and that the deterioration of solid carburizers in practice was due to the emission of these gases, it at once became evident that the use of a gaseous carburizer of proper composition offered the greatest possibility for actual control of the process. Illuminating gas, either coal or carburetted water gas, is a good carburizing agent, and has been used successfully in a number of commercial installations. It has, however, been claimed that it gives too hard and sharply marked a case if an attempt is made to carburize rapidly at high temperature. This paper shows that by case-hardening at a high temperature for a relatively short time, and then turning off the carburizing gas, and allowing the hot metal to soak in the furnace, there will be diffusion of the carbon toward the interior of the piece, and any desired type of case can be obtained. The use of ammonia in case-hardening is not recommended, since a brittle nitride of iron results.

The commercial aspects of case-hardening with gas cannot be treated in this paper. It seems, however, quite evident from the data presented here and in the accompanying paper on "The Heat Treatment of Steel in a Neutral Atmosphere" [as given last week, pp. 138-140] that it will be possible to work out a commercial process whereby the pieces are placed in the furnace, heated in a neutral atmosphere, carburized in gas of controlled composition, and kept hot in an atmosphere of neutral gas until the desired diffusion of the carbon has been obtained. The pieces must, of course, be removed from the furnace for quenching, but will be heated again in an atmosphere of neutral or perhaps slightly carburizing gas for their final heat treatments.

WALLWIN AND SINNATT BURNERS.

For the High-Pressure Air System.

There has been in use commercially for a long time past what is known as the Wallwin system of gas burning by the aid of air under pressure; and in a *brochure* entitled the "Burning of Gas—A New Principle," an explanation is given of the idea underlying the use with it of burners containing perforated dished discs, made under Wallwin and Sinnatt's patent. These discs, concave on the side on which the gas burns, are provided with perforations so arranged that the many streams of already thoroughly mixed gas and air are directed to one common point; and this is the point at which perfect combustion occurs. By making the concavity of the disc greater, the flame may be shortened as desired, until a condition is reached at which the point of perfect combustion is situated quite close to the disc.

It is remarked in the booklet that the flame forms a perfect cone; and no matter how the pressure of the gas is increased, each little stream of gas must pass through the common focus. There is no spreading of the flame, and no unburned gas zone; and each individual stream of gas helps to bring about the complete combustion of the remainder. The many different streams all converging to a point mix and stir up each other and induce combustion. Thus it is the patentees believe the principle to which they draw attention enables them to burn any volume of gas, at any desired rate, and obtain true economy all the time. An explanation is offered of the reasons why it is said to be impossible to effect the result described in the *brochure* by means of a flat or convex disc or gauze; and it is added that, with this burner, the thickness of the metal, the diameter and number of the perforations, and the diameter of the discs have required thought and continuous experiments to ensure success. The principle is one which can be applied to all kinds of fuel gases; the discs in varying circumstances requiring only slight modifications. It should be mentioned that the critical curvature of the discs has been determined for the pressure of air and gas which is used in the system of Messrs. Wallwin and Co., of Salford.

The system must be taken as a whole, as the makers point out that the burners will not work if they are simply attached to an ordinary gas supply. It is particularly suitable, and is claimed to be very economical, for use with soldering irons, tinmen's stoves, brazing burners, metal melting, and other cases where concentrated heat is required; and when large burners are needed, a system of compounding is adopted—a series of discs being so arranged that their flames converge on a common point, and blend into one large conical flame. Should a disc at any time get accidentally damaged, it can be easily replaced in a few seconds. Coming from theory to practice, it is stated by the firm that wherever they have applied this system it has "won golden opinions." Potential users will note that they express their willingness to deal individually with each case, taking into consideration the varying conditions.

Mr. George Waller, of Phœnix House, near Stroud, whose will has just been proved, left estate of the value of £12,881.

THE ASTORIA TUNNEL UNDER EAST RIVER FOR GAS DISTRIBUTION IN NEW YORK CITY.

THE FLOODING AND RECOVERY OF THE TUNNEL.

By Harold Carpenter, Resident Engineer, Astoria Tunnel—Astoria Light, Heat, and Power Company, New York City.

(Concluded from page 254.)

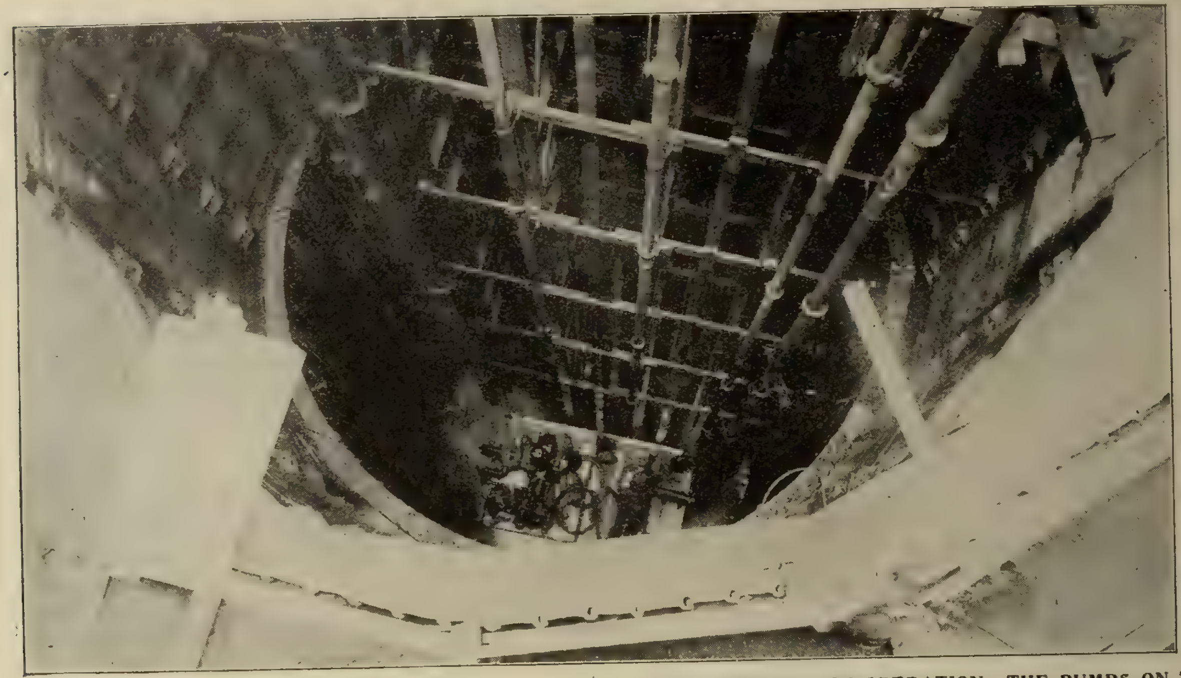


FIG. 5.—PUMPING-OUT THE ASTORIA SHAFT, NOV. 24, 1913. THREE AIR-LIFTS IN OPERATION. THE PUMPS ON THE PONTOON WERE STARTED A FEW HOURS LATER.

Pumping-Out the Tunnel.

For pumping-out the tunnel after the leak had been controlled by filling the entire heading with grout, the following preparations were made: One 1000-gallon and one 800-gallon pump were mounted on a steel pontoon in the Astoria shaft. An 18-inch ventilating pipe and three 8-inch pump discharge lines, which were already in the shaft, were converted into air-lifts by installing small air-lines in them. The three elevators were removed so that the elevator framework could be used to mount additional pumps.

On Nov. 24, 1913, at 7.50 A.M., the 18-inch and two 8-inch air-lifts were turned on. They lowered the level of the water 160 feet by 9 P.M., removing 1,140,000 gallons—an average of 1440 gallons per minute. The 1000-gallon pump was then cut in. As the work progressed, two pumps were used from the pontoon, assisted by the air-lifts, and three 600-gallon pumps mounted on the elevator framing. The discharges of the pumps were connected to the discharge lines already in place in the shaft for the original pumping plant, by means of 6-inch hose; and steam connections were made in the same manner. The bays of the elevator framing were 25 feet apart; and after the water was pumped down low enough so that the three pumps could be shifted, the pumps on the pontoon were used to hold the level of the water while the shift was being made. Conversely, the pumps on the elevator framing were used to hold the water while the connections of the pontoon pumps were being changed.

When pumping began, a gauge on a pipe in bulkhead B [fig. 4, *ante*, p. 253] read 92 lbs.—the figured pressure for this point. In the early pumping this gauge dropped lower than the head in the shaft by 19 lbs. A 5-inch pipe in bulkhead B was opened in order to assist the pumping by using the Bronx pumps, when the gauge began to rise rapidly until it was 24 lbs. higher than the shaft pressure—indicating that the flow was opening-up connection with the river pressure. The pipe was closed, and the gauge jumped to 58 lbs. higher than the shaft pressure.

At 10 A.M. on Nov. 25, the 18-inch air-lift was shut-down—having operated until the water was 200 feet below the top of the shaft which was an unusual performance, as the air-pipe only extended down a distance of 256 feet. About 2 P.M. the amount of water

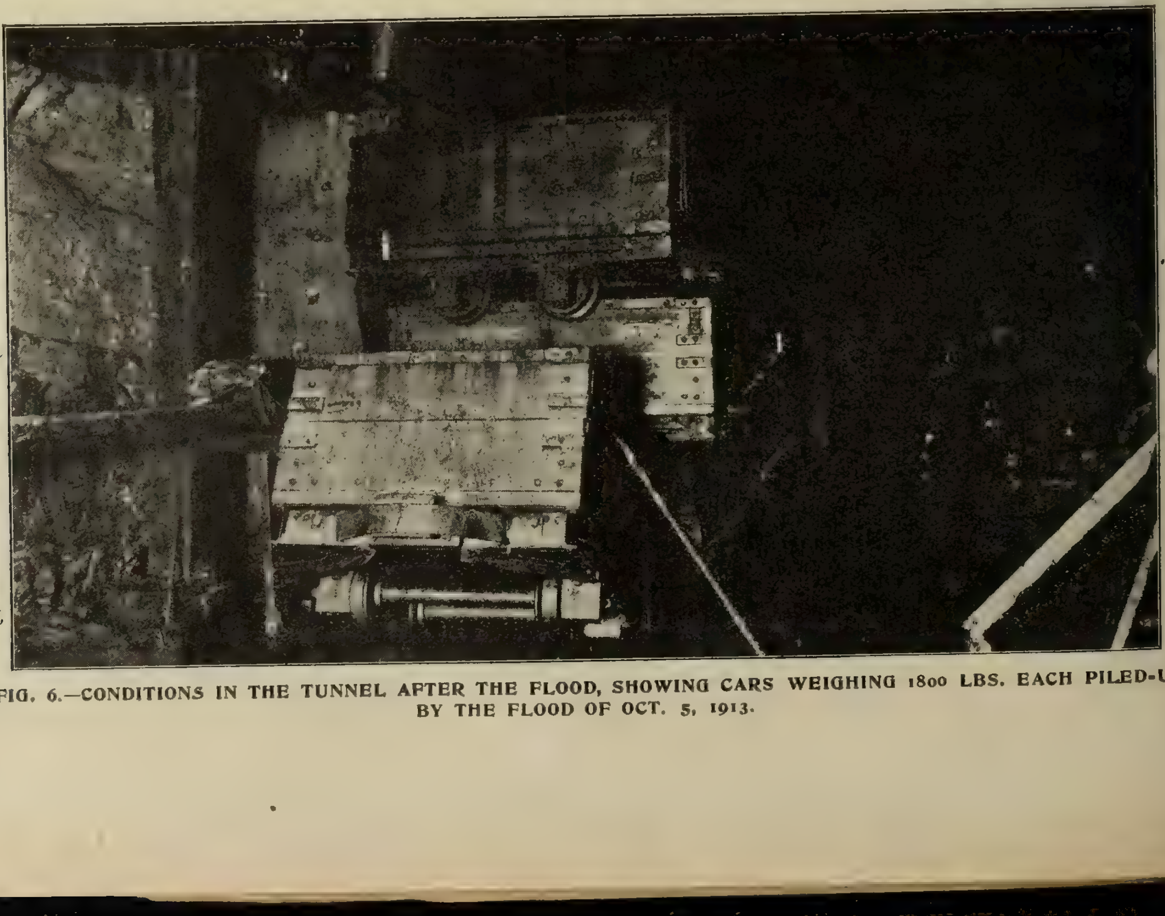


FIG. 6.—CONDITIONS IN THE TUNNEL AFTER THE FLOOD, SHOWING CARS WEIGHING 1800 LBS. EACH PILED-UP BY THE FLOOD OF OCT. 5, 1913.

ming into the shaft appeared suddenly to increase, as if some oppage had given way in the heading,

On Nov. 26, as the gauge at bulkhead B had been continually opping, and had apparently lost its connection with the river essure, the 5-inch pipe was again opened, and the Bronx pumps erated, when the gauge instantly dropped 13 lbs. more.

As the Astoria heading was about 20 feet higher than the toria portal, it was feared that a vacuum would form in the ading and cause a rush of water that would swamp the pumps. looking for a means of forcing air into the heading, a 2-inch e in bulkhead B was cleared; and instantly the gauge, which s on another pipe on the opposite half of the bulkhead, dropped other 15 lbs. (to the shaft pressure), and then 3 lbs. more.

The gauge fluctuated—first higher, then lower than the shaft essure—in a very extraordinary manner. On Nov. 28, when it uld have read *zero*, it read 7 lbs., and continued to do so to end of the pumping. When the water reached an elevation out 14 feet above the bottom of the tunnel at the portal, the merged pumps were cut-in. Approximately 24,000,000 gallons water were pumped.

Vacuum in Heading Holds-back Water.

The attempt to force air into the heading from the Bronx end led. At 3.30 P.M. on Nov. 28, it became evident that a vacuum s forming in the heading, as the water level had reached a point that time which it should not have reached until midnight. It s calculated that 1,000,000 gallons were held back in the tunnel ove the elevation of the water in the shaft.

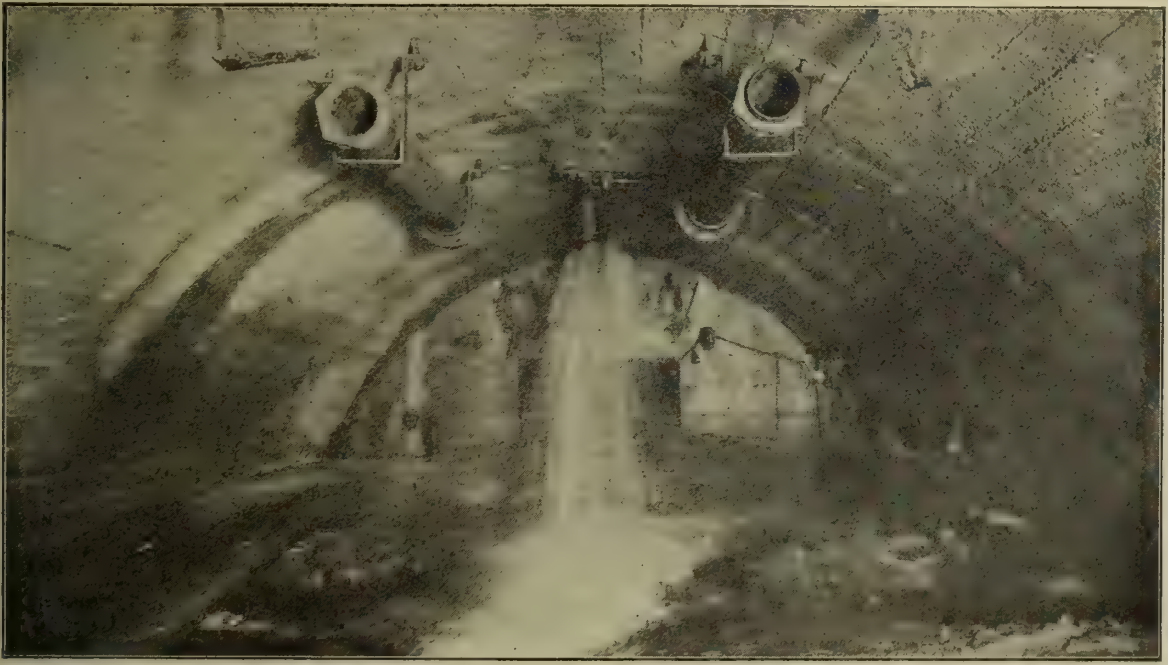


FIG. 7.—BULKHEAD AND GROUT BANK, DEC. 1, 1913. SHOWING THE GROUT BANK WHICH PILED-UP AGAINST THE BULKHEAD DOOR, AND FINALLY STOPPED THE FLOW OF WATER. THE DOOR HAD JAMMED ON A STICK OF WOOD THUS ALLOWING THE WATER AND GROUT TO COME THROUGH. THE DRAIN PIPES ARE 3 FEET TO 4 FEET BELOW THE DOOR.

An attempt to force air through an air-line which was known to end well into the tunnel finally succeeded, most fortunately, en the air pressure reached 165 lbs.—evidently blowing out e stoppage, as the air then went in at 35 lbs. Air was then t constantly on this line, and the lowering of the water pro-ded.

The last of the 8-inch air-lifts were shut-down at 11.30 A.M. on v. 29, having worked continuously from 7.50 A.M. on Nov. 24. e water was 234 feet below the top of the shaft, and the end of air-pipe had only 13 feet submergence—an unusual perform-e for an air-lift.

Entering the Tunnel for Inspection.

At 5 A.M. on Nov. 30, when the water reached a point 4 feet ove the crown of the arch at the portal, the air which had en forced into the heading began to break into the atmosphere bubbling up through the water violently. The pumps were wed-down, and the escape of the air lowered the water to the el of the portal. The full 100 lbs. of air was then blown into tunnel to ventilate it. At 7.30 P.M. the water reached a level 4·5 feet below the crown of the arch at the portal, which meant t it was 13·5 feet deep at the portal, diminishing to nothing at oint 2600 feet from the portal, or 900 feet from bulkhead A. it was most important to know the actual conditions in the ding, the Engineers' Agent and Resident Engineer manned two boats, and (with safety electric lamps) proceeded to the head—the pumps holding the level of the water. Heavy timber ns were encountered, and had to be cleared away as the boats ceeded. On reaching the face of bulkhead A, it was found t, while the safety door had been dropped as reported, it had jammed on something (afterwards found to be a small piece of wood) and had not closed tight. This, together with the 8-inch drain-pipe, was responsible for flooding the Astoria end of the tunnel. Also, when the heading was pumped full of cement grout, the partly-open door allowed the grout to run out into the main tunnel for a distance of 500 feet. A dam that had been built to hold the drainage water while concreting the invert, stopped the flow of the grout along the tunnel invert, so that the latter gradually formed a bank against the door and finally sealed it off. This bank was from 12 feet deep at the bulkhead to 1 foot deep 500 feet distant; and it varied from fairly well-set cement at the doorway to white mud farther away, through which one had to wade.

The inspection showed that the only leaks in the tunnel were through a 3-inch cable pipe [see fig. 7] and through one of the 8-inch drain-pipes (whose valve had not been closed, as already noted), amounting in all to less than 1000 gallons per minute, with practically no pressure. Through the open drain-pipe and an 18-inch pipe that led away its discharge to a point 1000 feet distant, there had run into the tunnel about 500 cubic yards of greensand, coal, and refuse. This was entirely separate from the grout. The party reached the shaft again at 9 P.M. The unwatering of the tunnel was completed at 4 P.M. on Dec. 1.

Valves on the Bulkhead Drain Pipes.

On Dec. 3 a trench was excavated in the grout bank to get access to, and control of, the valves on the bulkhead drains, from one or more of which water was flowing. Two of the pipes were found closed, but the third pipe was open and running a part stream. As soon as the valve was moved, water broke out in large volume. The valve evidently had choked with rubbish from the leak and had remained so, fortunately, during the unwatering of the tunnel and the subsequent period. It was most fortunate that the partial stoppage of this pipe did not give way while the inspection party was in the heading on the night of Nov. 30. The condition of this pipe accounted for some of the peculiar and sudden changes in pressures and conditions which had occurred during pumping.

The large flow caused by disturbing the valve reduced the pressure at the gauge in bulkhead B [fig. 4] from 32 lbs. to 17 lbs., showing direct connection between the two, and indicating also that the source of the leak had not been completely shut off from the river. The valve was then regulated so as not to disturb the pressure between the bulkheads.

In the meantime work had been started on an additional safety bulkhead reinforced with rails, 60 feet back of bulkhead A, for additional protection of the shaft and tunnel. The pumping plant at the Astoria shaft was increased to a capacity of 9800 gallons per minute, which was greater than the boiler capacity.

Final Grouting of the Leak.

On Dec. 16 the drilling of test-holes and core-borings in the side of the tunnel just outside bulkhead A was begun, in an attempt to locate the water-bearing seam, and grout it to shut off the remaining connection with the river. The test-holes were calculated to be only about 20 feet from the seam, and were carefully directed to intersect the line of the seam as plotted from the data available. The core-borings were aimed to reach the seam

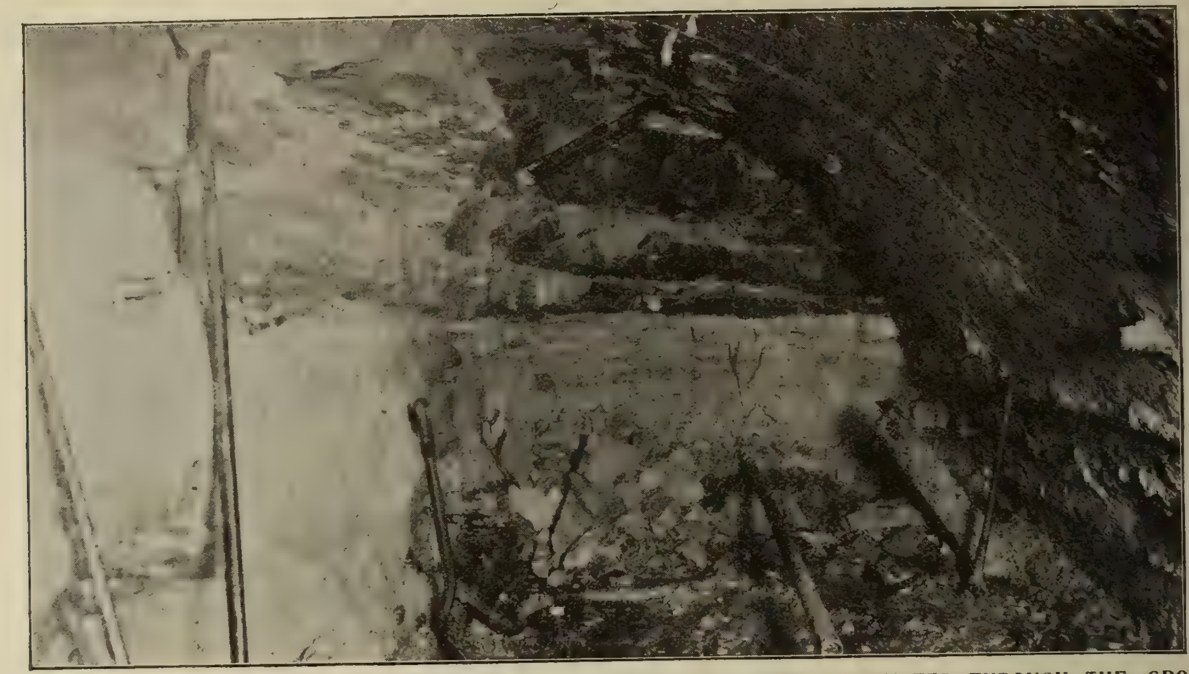


FIG. 8.—EXCAVATION THROUGH THE GROUT, JAN. 10, 1914. THE DRIFT EXCAVATED THROUGH THE GROUT BETWEEN THE SAFETY BULKHEADS PLACED TO STOP THE FLOW OF WATER FROM THE FLOOD OF OCT. 5, 1913. THE PIPE ON THE RIGHT IS THE CORE-DRILL ROD THROUGH WHICH THE HEADING WAS FILLED WITH GROUT. THE DRILL HEAD AND 28 FEET OF PIPE WERE REMOVED. THE TIMBER AT THE TOP IS PART OF A STRUT TO BUTTRESS "A."—FIG. 4, *ante*, p. 253.

at a point farther in, nearer the original water hole. About seventeen test-holes and ten diamond-drill core-borings were drilled into the side of the tunnel, and through the bulkhead A into the bench near the water hole.

One of these test-holes, about 22 feet long, on Dec. 17, struck decomposed rock (greensand) and water under the full pressure. It was grouted with 3351 bags of cement under high pressure. Conditions were noted by means of pressure gauges on bulkheads A and B, and by permitting the pipes in bulkhead B to remain open. Grout appeared at once at bulkhead B, showing that the grout-hole was connected to the original leak, and that the latter was still open into the heading. This grouting was effective in stopping the flow.

While the grout was being given time to set, a thorough exploration of the bench and heading was made through bulkhead A by means of core-borings; but no further water was encountered. This work was completed on Jan. 4, 1914—three months after the flood of Oct. 5.

Excavation of Grout from Heading.

On Jan. 5 excavation of the grout from the heading between bulkheads A and B was commenced [see fig. 8]. The bulkhead door was found jammed open by a stick of wood 1 inch thick and 4 inches wide. The door was opened on Jan. 7. A drift through the grout was completed up to the door in bulkhead B, and the door was opened on Jan. 13. The entire space between bulkhead A and bulkhead C was filled with grout, except for some sand at the bottom; and the space between bulkhead C and bulkhead B was filled with grout to within 2 feet of the top. This grout was highly stratified. Some of it was set fairly hard, while next to it would be a layer of grout of the consistency of chalk.

A most peculiar fact was that, while the total amount of cement used in grouting from both ends was only about 600 cubic yards, nevertheless 1200 cubic yards of solid grout was removed from the tunnel and the space between the bulkheads—not to mention the quantity that evidently must have remained in the seams and stopped the flow of water.

This more than doubling in volume of the grout can only be explained on the assumption that cement in the form of grout does not maintain constant volume. The fact that the discharge of sand and débris from the leak was mostly carried 1000 feet away, and kept entirely distinct and separate from the white material, and, further, that this discharge had no white material in it whatever, makes it improbable, in the writer's opinion, that the increased volume was due to a mixture of grout and dolomitic sand from the leak. The discharged material was all very dark in colour, and the sand from seams had always been dark, except in a very few instances when material similar to beach sand had come in.

Most of the grout was poorly set, and was, in fact, largely removed with picks. The diamond bit was found embedded in a block of grout that, in turn, was buried under 4 feet of greensand

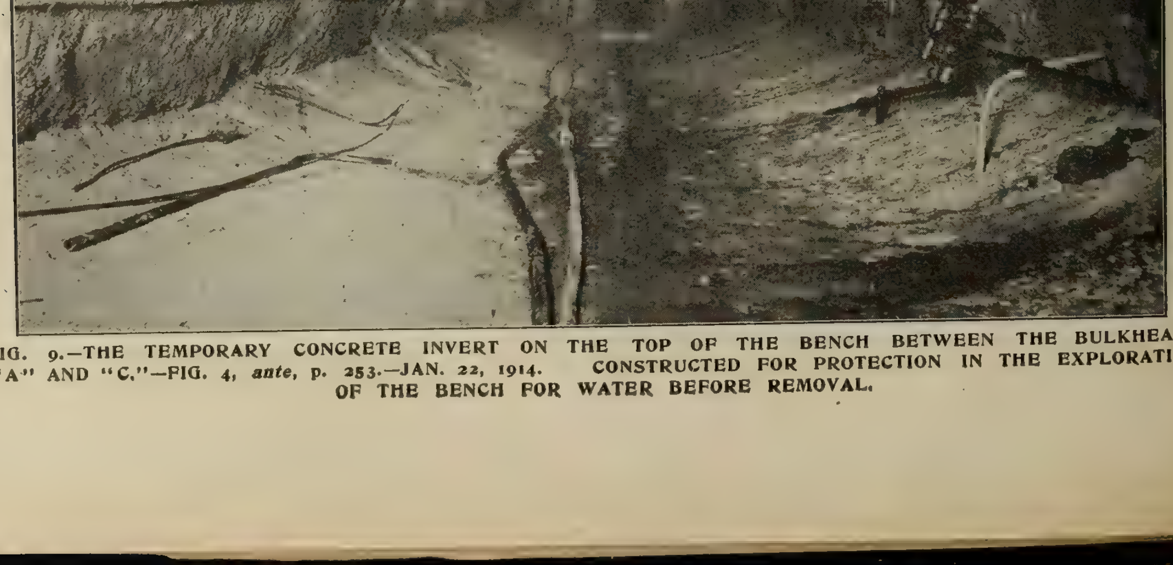


FIG. 9.—THE TEMPORARY CONCRETE INVERT ON THE TOP OF THE BENCH BETWEEN THE BULKHEADS "A" AND "C."—FIG. 4, *ante*, p. 253.—JAN. 22, 1914. CONSTRUCTED FOR PROTECTION IN THE EXPLORATION OF THE BENCH FOR WATER BEFORE REMOVAL.

and débris, being completely separated from the main mass of grout. The removal of grout was completed on Jan. 14.

Bench Excavation Resumed Under Temporary Invert.

The top of the remaining bench between bulkheads A and C was trimmed off at 2 feet below the springing line, and a concrete arch invert built over the entire top of the bench, bonded underneath the concrete arch lining. The purpose was to explore with test-holes the entire bench and grout any water seams through the invert arch before excavating. This invert was completed on Jan. 20.

On Jan. 22 the excavation of the 23·5 feet of bench between bulkheads C and B was resumed very slowly, preceded by many test-holes. The drilling of test-holes systematically located was also begun through the invert on top of the bench between bulkheads A and C. On Jan. 27 water and greensand under pressure were encountered in some of the test-holes (just south of bulkhead C) and grouted. On Jan. 31 very bad ground was exposed in the west side of the excavation, between bulkheads C and B; and at 3 A.M. on Feb. 1, water broke out and flooded this section to the springing-line, but developed no pressure. The section was lined with thick concrete walls, draining the water through pipes that were later grouted.

After the top of the bench between bulkheads A and C had been thoroughly explored with test-holes drilled through the temporary invert, three test-hole pits were excavated across the bench and concreted, in order to allow still deeper exploration with test-holes from these pits. In all, 284 test-holes were drilled in the bench between bulkheads A and C.

On Feb. 16 the excavation of the bench in the danger section just north of the Astoria bulkhead A was resumed, and advanced very carefully, and with as little blasting as possible. As soon as each section of about 20 feet was excavated, it was immediately lined with concrete before proceeding farther. The rock of this entire section was very much disintegrated—wet and full of seams.

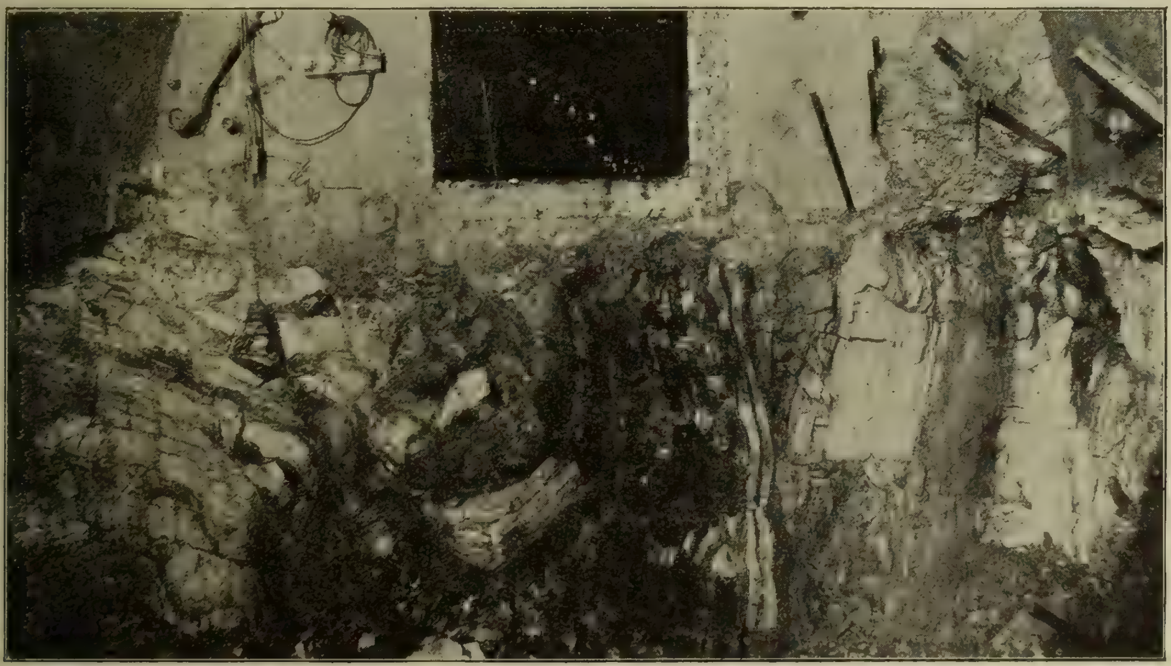


FIG. 10.—FACE OF THE BENCH, SHOWING THE SEAMS AND DISINTEGRATED ROCK, JAN. 30, 1914. LOOKING SOUTH FROM THE BRONX BULKHEAD TO BULKHEAD "C."—FIG. 4—*ante*, p. 253.

Seam that Caused Flood Laid Bare.

On March 2-4, 1914, the second section, 17 feet to 46 feet north of bulkhead A, was excavated. The rock was very bad. The excavation on its westerly side exposed what was undoubtedly the seam that caused the flood on Oct. 5, 1913.

This seam was from a few inches to 2 ft. 6 in. wide, as exposed. Portions of it were filled with refuse exactly like that which came in during the flood, other portions were filled with grout, and still others with a combination of grout and refuse. The west side of the excavation was very bad disintegrated rock and seams of sand and grout. At one point there was a synclinal fold, which changed the stratification from 25° with the horizontal abruptly to the vertical. One seam was grouted solid, 6 inches thick. Several flows of water occurred, during one of which a seam was exposed for an area of 7 feet by 9 feet (apparently a vertical section), and a water-hole washed out 3 ft. 6 in. square. They were stopped by grouting through pipes and drill-holes without unusual difficulties.

The excavation of the bench was completed on March 19, except for a small portion underneath bulkhead A, which could not be removed until June 16, 1914.

Cast-Steel Lining in the Trouble Zone.

It was decided to line 400 feet of the tunnel through the trouble zone with cast-steel rings. Work was begun on this on April 17, 1914, and completed on Nov. 29. During the placing of the steel rings the tunnel and shafts at each end were always kept protected by safety bulkheads; three additional ones being constructed for this purpose. No further flows of water occurred, however. The removal of these bulkheads was completed on Nov. 24, 1914.

In the meantime, the lining of the rest of the tunnel with concrete was going forward. The concrete lining (including the concrete inner lining of the steel rings) was completed on Jan. 10, 1915. The first piece of the 72-inch gas-mains was lowered and placed in position on Jan. 23, 1915. The work of installing the two mains is now [Oct. 1, 1915] nearing completion.

Quantities of Materials: Accidents.

Eight safety bulkheads across the full-section tunnel, and three across the heading, were constructed to protect the tunnel from floods. In addition, thirty-five temporary bulkheads had been built over portions of the heading or bench to confine water for grouting.

The construction of the tunnel involved about 100,000 cubic yards of excavation, including surface and miscellaneous, of which about 90,000 cubic yards was rock. Of this, 39,500 cubic yards of rock was crushed on the job, and largely used in the concrete lining. Concrete placed amounted to 36,000 cubic yards, of which 32,000 cubic yards was for permanent lining. The lining required 200,000 bags of cement; foundations, bulkheads, &c., 27,000 bags; for grouting 118,000 bags were used—making a total of 345,000 bags.

Test-hole drilling to explore for water included 3318 holes of a total length of 43,000 feet. They were grouted with 26,700 bags of cement. And, further, seventeen diamond-drill holes totalling 1500 feet were drilled, consuming 1800 bags of cement in grouting them. For grouting the shaft and tunnel lining, both concrete and metal, 63,000 bags of cement were used. Grouting behind the bulkhead consumed 26,500 bags.

For blasting 195,000 lbs. of dynamite were used, with a record of only one accident from its use, resulting in one death. The coal consumption was 62,000 long tons [up to Jan. 1, 1915]. About 226,000,000 cubic feet of water were pumped out of the tunnel, representing a consumption of approximately 628,000 H.P. hour for pumping alone.

Notwithstanding the extremely hazardous nature of the work, extending over a period of four-and-a-half years, only six fatal accidents occurred, of which only one was due to dynamite, and none to the dangerous conditions due to floods. This is perhaps a unique record of construction work of a similar nature, and is due to the unusual precautions taken for safety.

Inception of Project and Organization.

The credit for the inception and carrying out of the project of providing for the ultimate removal at a future date of all the gas-lamps from Manhattan to a great central plant on Long Island (the Astoria plant) and the conveying of gas from this plant to Manhattan and Bronx by means of tunnels is entirely due to Mr. William H. Bradley, the Chief Engineer of the Consolidated Gas Company, who originally conceived this plan nearly thirty years ago, and, with the completion of the tunnel described in this article, now sees it finally certain of being carried to completion.

The entire work of engineering, organization, and construction was carried on by the Consolidated Gas Company of New York, through its subsidiary—the Astoria Light, Heat, and Power

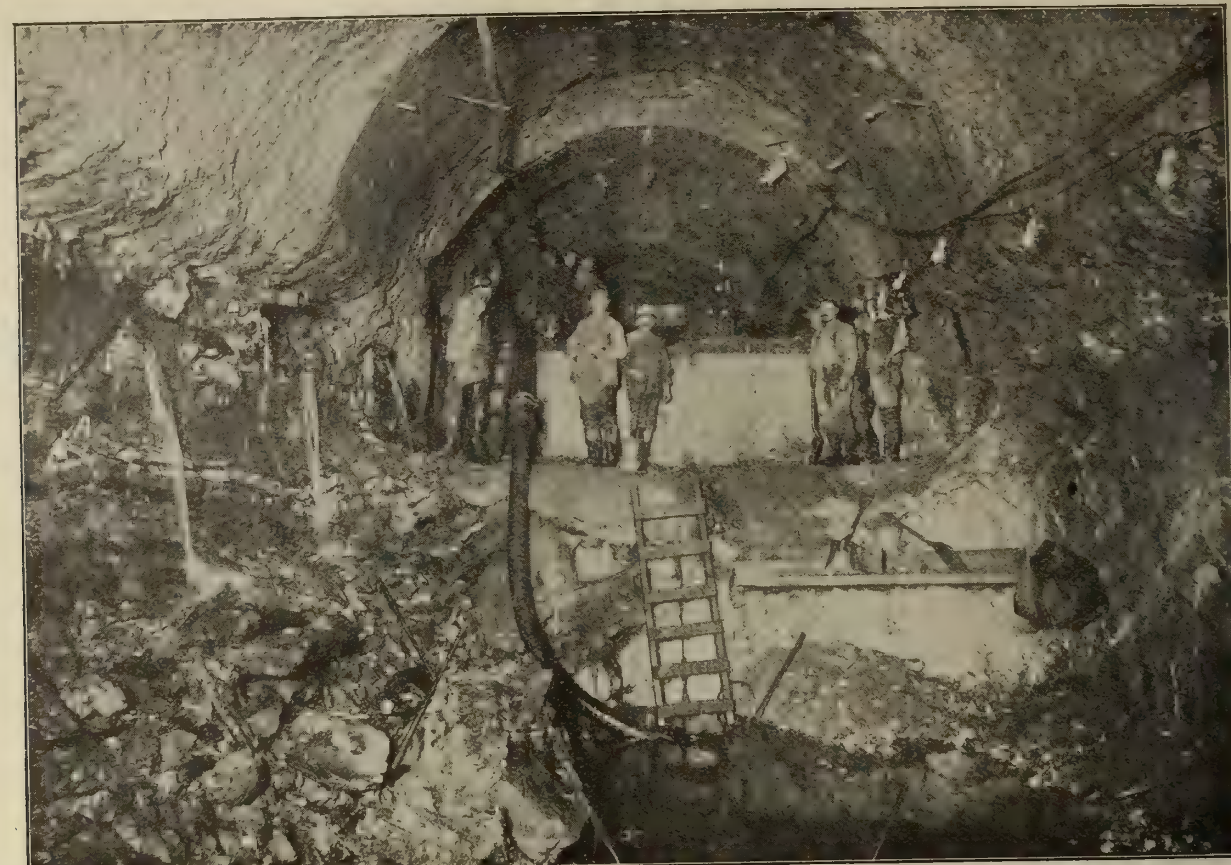


FIG. 11.—EXCAVATION OF THE BENCH THROUGH THE FLOOD SECTION, LOOKING NORTH FROM BULKHEAD "A" TOWARDS BULKHEAD "C."—FIG. 4, *ante*, p. 253. THE CONCRETE WALL AT THE BACK OF THE MEN IS THE FACE OF ONE OF THE TEST-HOLE PITS CONCRETED TO EXPLORE THE BENCH FOR WATER. ON THE LEFT SIDE OF THE PICTURE IS A PORTION OF THE SEAM WHICH CAUSED THE FLOOD OF OCT. 5, 1913, FILLED WITH GROUT AND REFUSE. MAY BE SEEN AT "A."

Company—under the direction of Mr. Bradley as Chief Engineer, Mr. W. Cullen Morris as Engineer of Construction, and Mr. Harold Carpenter as Resident Engineer—by Jacobs and Davies (Inc.) as Tunnel Engineers—a firm that engineered the Pennsylvania Railroad Hudson River tunnels, the Hudson and Manhattan Railway tunnels, and much similar work in other parts of the world. Mr. Vivian Messiter, as Engineer's Agent, was in charge for Messrs. Jacobs and Davies.

THE NATIONAL COAL INDUSTRY.*

Possibly no better occasion could have been chosen than the present time for the publication of a book dealing authoritatively with the British coal trade from the economic standpoint; for the problems connected with the carrying on of the greatest of our national industries, and the most profitable utilization of its product have—with the exception perhaps of the great coal strike a few years ago—never been more in the public mind. It is pleasing, therefore, to find that the last-issued volume of the "National Industries" series [edited by Mr. Henry Higgs, C.B.] is on this subject, and that the author is Professor H. Stanley Jevons, in support of whose claim to attention it may be stated that he was formerly Professor of Economics at the University College of South Wales and Monmouthshire, "where experience has shown the urgency of coal trade problems."

The growing part which the coal trade and the miners are destined to play in the economy and the politics of this country has always been before the author as defining the object and the scope of his book—which is aimed at giving a popular account of the coal mining industry and the coal trade of the British Isles, with special attention to the economic and social aspects. He foresees that stricter and more extensive legislative regulation of the mining industry will be demanded, and that the nationalization of mines will be seriously proposed and discussed; and it is his feeling that no adequate consideration of such measures by the public or in Parliament is possible while there is widespread ignorance of the modern methods of working coal, the conditions of employment of coal miners, &c. Therefore much information is furnished which bears on this point of view. The facts and figures quoted are so many that their collection and collation must have entailed—as, indeed, Professor Jevons shows has been the case—the expenditure of a great deal of time and labour. There are a number of illustrations—including a coloured map of the coal fields, various diagrams and photographs of coal-mining operations, and charts relating to supply and demand, prices and freights. Not the least useful feature of the book, too, is a bibliography of the coal trade—set out under the heads of descriptive, general, historical, social, trade unions and wages, technical, economic, commercial, annuals and periodicals, and Government publications. The volume extends to nearly 900 pages; so that a complete assimilation of its contents would take an appreciable amount of time. But people desirous of gaining an insight into so complicated a position of affairs as is presented by the conditions governing the coal mining industry, will, so far from begrudging time spent on its study, experience a feeling of thankfulness on finding that they can advance their knowledge so far within the two covers of one book.

From an explanation of coal and coal seams, the reader passes to descriptions of the different fields, the methods of mining and selling coal, and the economics of the trade. Then there are chapters on wages, safety, mining law, and the conditions of life of miners. Some attention is also given to more general questions—the future of the British coal trade, the world's coal resources, and oil fuel. With such an enormous field to cover, it will be understood that Professor Jevons has not attempted to deal exhaustively with any one particular branch of his subject; it is just what he intended it to be—a popular account of the mining industry and coal trade of this country, written by an author well qualified to undertake the task.

Provisional Orders for 1916.

The Board of Trade give notice to parties contemplating the promotion of Provisional Orders in respect of gas and water, electric lighting, &c., that, for the duration of the war, they will not be prepared to entertain such applications except in cases in which they are satisfied that extreme urgency exists.

Thomas Hawksley Lecture.—At a meeting of the Institution of Mechanical Engineers last Friday week, Mr. Dugald Clerk, D.Sc., F.R.S., delivered the Thomas Hawksley Lecture; taking as his subject the "World's Sources of Fuel and Motive Power." Dealing with coal, he said that at the present rate of consumption the world's supply would last 5400 years, and that of the United Kingdom for 500 years. Taking all the lines of economy, it was estimated that about 60 per cent. of the coal burned annually might be saved. He dealt also with the development of hot air and internal combustion engines. He described the gas-engine made by the Rev. Mr. Cecil in 1820, and the Lenoir engine (working at atmospheric pressure) of 1862. In 1876 Otto introduced the first compression engine; Mr. Clerk following two years later with a compression engine, and in 1880 with his two-cycle engine.

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* "British Coal Trade," by H. Stanley Jevons, M.A., B.Sc., F.S.S., F.G.S., Professor of Economics at the University of Allahabad. London: Kegan Paul, Trench, Trübner, and Co., Limited. 1915. Price 6s. net.

BYE-PRODUCT COKING AND CHEMISTRY.

By Douglas R. Wattleworth.

In these days of strife, when everyone is calling that Britain shall capture the trade, and especially the chemical trade, of the Germans, it comes as a shock to be told that there are still works in the country engaged in the manufacture of chemical substances at which no chemist is employed. Yet that this is so we have the word of Mr. T. G. Watts, speaking at a general meeting of the South Wales Institute of Engineers last September. We are all more or less aware, from the leaders, not only of our Technical Journals, but also even of our daily papers, that in the matter of chemical research and the co-operation of our universities and industries, we have allowed the German nation to get far ahead of us. There is no doubt that we have at last begun to shake off our lethargy, and look round to see which is the best course to pursue; but in this, as in most other things which we as a nation do, we move but slowly. Let us hope that we shall, however, be none the less sure.

No wonder that some of us are inclined to be pessimistic in regard to our success in the commercial campaign, when such ancient and unenlightened methods as that presented to us by Mr. Watts are still in vogue. Fortunately, such places are very few and far between, and are generally under some old and narrow-minded management of long standing, who look upon a laboratory and a chemist as being unnecessary luxuries, and who are quite confident that their experience is equal to, and even better than, all the analyses and tests and chemical control of the expert. A bye-product coking plant is almost the last place one would look for one of these managers, who are, one might say, a decade or more behind the times. Plants which have been erected in connected with collieries, and where the colliery manager has taken over the management of the ovens, are the places where such men are apt to be found.

Perhaps in no single process is there so much scope for the chemist as in the distillation of coal with the recovery of the various bye-products. This has been recognized to a more marked degree in the gas industry; and much good work has been done, both at the works laboratories and also by many academical workers who have taken up the subject. The major part of all such research has been of great use to the coke-oven world, yet there are many features in the carbonization of coal in the light charges of a retort which differ materially from the conditions arising from the distillation of charges of 8 or 10 tons.

Apart from research work, let us look at the daily routine work of the coke-oven chemist, which is absolutely necessary for the scientific and economical operation of the plant. It is the opinion of the management at a large number of works that any youth may be trained to carry out this daily routine work in a mechanical manner, and thus do away with the expense of keeping a trained chemist. Such men are almost as bad as those who employ no chemical control at all. Of course, if the manager himself is a qualified chemist, and is able to direct the labour of the laboratory worker, well and good; but very often the manager possesses only a very superficial knowledge of chemistry, or else has not the time to attend to the laboratory work personally. Under these circumstances, the shortcomings of the laboratory worker become apparent. The writer knows of large works where several such laboratory assistants are employed, who can make analysis of all the materials in use on the works, and give the most reliable results, and yet do not know sufficient chemistry to understand the simplest reaction which they make use of in their daily work. Of what use is a man like this in the economical working of a plant, if put in charge of the laboratory? None whatever. He may be able to tell with unimpeachable accuracy the percentage of free and fixed ammonia in a waste liquor, or how much volatile matter there is in a certain coal, because he has done the same thing so often that he is expert. Ask him to trace the reason for a fall in the make of sulphate of ammonia, and he is lost. As mentioned before, the daily routine is necessary for the economical running of a plant. There are so many channels open for waste that a very watchful eye is needed; and only the constant taking of samples in the various directions, and the careful testing of them, can possibly lead to maximum productions.

Beginning with the coal-washery. Should more than one class of coal be used, every consignment should be carefully sampled, and the moisture, ash, sulphur, and volatile matter carefully determined. Occasionally, also, the percentage of phosphorus and nitrogen should be found. Those coals which contain chlorides should be regularly analyzed for this impurity. Much useful information may also be gathered by submitting each class of coal from time to time to distillation in one of the many small-scale plants which have been designed for the purpose. By means of this test, figures for yield of coke, tar, ammonia, benzol, gas, &c., are obtained, which, if not the amount recovered in practice, are certainly useful for purposes of comparison.

The refuse from the washery should be daily checked for its content of coal, especially in those plants where ancient and ramshackle washing plants are in use. In the more modern washeries, so steady and reliable is their working that samples twice or three times per week are quite sufficient. The moisture and ash in the washed coal leaving the washery should be estimated daily; also in the coal as charged to the ovens. It is also desirable to test this coal for chlorides fairly often; and the water used in the washery should be periodically examined for the same substances. Samples of coke taken regularly, and the time of charging noted, allow one to trace the passage of coal high in ash or sulphur through the ovens.

Passing on to the bye-product side, there is the working of the ammonia stills and the saturators to check, and the amount of ammonia passing away in the waste liquor and in the gas, to determine. The quality of the sulphate of ammonia must be kept up to the standard, and the cause of excessive moisture or free acid immediately traced and removed.

On coming to the benzol plant, we find even more work still for the chemist, especially if a rectification plant be attached. First, attention must be paid to the scrubbing oil; its specific gravity and the amount of water it contains being determined. This latter particularly should be watched, as a very little water causes a big falling off in the absorbing properties of the oil, besides causing endless trouble in the stills by priming. The oil leaving the coolers after being treated in the still, must be regularly submitted to a fractional distillation test, so that only the minimum amount of benzol shall be left therein.

It is also desirable to test the gas after the benzol scrubbers from time to time for benzol; and though no absolutely reliable test has yet been brought to perfection, yet by adopting a standard method, comparative results may be obtained. Perhaps it would not be out of place to describe the method the writer employs for this test. About half a cubic metre of the gas is passed through nitrobenzene, which possesses the property of absorbing the benzol from the gas, at the rate of about 30 to 40 litres per hour. The nitrobenzene and benzol are then carefully fractionated and the benzol collected in a cylinder graduated in tenths of a c.c. This fractionation is readily affected owing to the high boiling-point of the nitrobenzene (206° C.). In fractionating, the distillate is collected up to 200° C. A little water generally comes over with the benzol; and this is allowed for in the measure. By always using the same method, under, as far as possible, the same conditions, and by carefully noting the temperature of the gas entering and leaving the scrubbers during the test, much information can be gathered as to the efficiency of the scrubbing. Another method is to determine the amount of benzol in the gas before the scrubbers by means of ice-cooled heavy paraffin, and compare the result with the actual yield obtained.

The actual separation of the crude benzol from the absorbing medium, and the keeping of the storage tanks at 65 per cent. to 120° C. requires very careful attention, and frequent distillations of samples of the crude benzol. The whole regulation of the plant here depends on the chemist. No rule-of-thumb methods will apply for telling if the stock is below or above strength.

In the refining plant, the control of the chemist is required almost more urgently than ever. When the crude benzol is fractionated into raw benzol, raw toluol, &c., the distillate must be constantly sampled and subjected to a distillation test, in order to determine the point at which the fraction should be "cut." The washing of the raw products, and their subsequent redistillation for refined products, must also be carefully watched in the same manner, so that they shall conform with the specifications of the buyers, which in many cases are very severe.

The foregoing gives a rough idea of the usual routine work which the chemist of an average coking plant is called upon to do. On top of this, he may have to undertake the examination of endless other things. Among the incidental jobs which often fall to his lot, the following may be mentioned: Analysis of gas, water, fire-bricks and clays, lime, &c.; tests on the waste gases and regulation of ovens; examination of the tar, &c. Where other departments exist—such as oxide purification plants for the gas, water-softening apparatus, &c.—the chemist must watch these as well, as it is only by the strictest chemical control that the respective units can be worked at their highest efficiency.

From this brief *résumé*, it will be seen what enormous possibilities there are for waste and inefficiency to occur. The much-talked-of experience may possibly tell the approximate amount of moisture in a washed coal, but never the percentage of ash. It may give an idea of the amount of free and fixed ammonia in a waste liquor, but how determine the free acid in sulphate or the amount of ammonia in the gas leaving the saturators? The laboratory worker with no chemical knowledge may be able, in a mechanical manner, to carry out all the above tests and analyses; but if he cannot convert the result of his labours into "*£ s. d.*," he is of very little value to his employers. It is on a works like a coking and bye-product plant that the real value of a trained chemist is realized. With so many operations depending upon chemical and physical laws, for their successful working, his knowledge and skill are in constant demand.

So far only the actual daily routine work of the chemist has been mentioned; but what of the research work of which one hears so much nowadays? The great majority of coking plants possess really well fitted laboratories; but one can quite understand that, with so much routine work, and usually only one chemist and an assistant to do it, very little time is to spare for anything further. We talk of submitting our problems to the universities; but experience shows us that up to the present our academicians are not sufficiently intimate with manufacturing conditions to fully appreciate the difficulties they present. The works chemist is the man in daily touch with the operations. He has intimate acquaintance with every phase, whereas university men can without doubt better carry out research work.

It is only to the closest co-operation between the two, then, that we can look for the future progress of the industry along scientific lines. Since the outbreak of the war, progress in this direction has undoubtedly been made; and there is no reason why we should not only catch the Germans, but beat them at their own game. And yet when we come to think of those plants in South Wales . . . !

SUPPLY OF GAS IN WAR TIME.

NOT THE SAME AS OTHER YEARS.

By A Provincial Manager.

Anyone glancing casually through the Gas Press cannot fail to be impressed with the amount of unrest existing among employees at some gas-works. The reported cases refer more particularly to large concerns, where the representative trade union has a standing; but it does not follow because prominence is not given to the labour troubles in smaller works, that they are without anxiety in this direction.

Since the declaration of war, through the calling-up of reservists, and the enlistment of the medically fit, the labour resources of gas-works have diminished to an alarming extent; and this is felt more acutely in industrial centres where government work is carried on. There has been, and is at the present moment, undue competition in labour circles between firms who are in a position to pay an exorbitant figure for labour. Consequently, many men until recently employed on gas-works are to be seen working for firms who will only require their services as long as the Government finds it necessary to place remunerative contracts with them. Now, when it is taken into consideration that the commodity we supply has become more than ever an absolute public necessity, inasmuch as gas is required to facilitate the execution of much Government work, it is apparent that any undue hampering of gas-works labour resources must have an adverse effect upon the production of the needed commodity, and will ultimately reflect upon the quantity of work turned out by some Government contractors. Competition is looked upon as the life-giving impetus of industry; but it is nevertheless folly to let competition in labour retard the production of the commodity essentially necessary to carry on the self-same important industries.

I mentioned before that there is competition in industrial centres; and I know cases where fitters have left gas-works employ to go to works in the same neighbourhood at a rate of wages equivalent to 40 per cent. increase. Reliable stokers are almost unprocurable; and no matter what advance in wages gas undertakings are prepared to grant, their financial resources sooner or later cannot compete with firms who are, broadly speaking, subsidized by Government. The gas industry is faced with the unpleasant fact that, owing to abnormal circumstances, a large percentage of their more skilled and medically fit staff are either on active service or have gravitated to quarters where pay for the time being is more remunerative. How to meet such a contingency is a problem to be dealt with by many managers in charge of gas-works.

A case in point came forcibly before me. At a comparatively small works situate in a country district, although supplying an area containing manufacturing works, labour became so scarce that the foreman on several occasions had to do stoking for periods of eighteen hours at a stretch, to ensure even a reduced supply of gas being delivered to the district. The management received letters and telephone messages from firms on Government work, dwelling upon the inconvenience experienced owing to restricted pressure or an insufficient supply of gas. At another works, the manager and staff have had to assist in the emptying and refilling of purifiers, so as to prevent foul gas passing to the district. Maintenance of public lamps is sadly lacking in many areas, due to shortness of labour, or to newly-engaged incompetents. Yet, in these abnormal times, it is surprising how little the general public appreciate the fact that gas supply in war is not the same as in other years, and how soon they themselves complain when their light is less brilliant than usual, owing perhaps to temporarily diminished pressure or to a drop in calorific value.

Public bodies all over the kingdom are economizing in public lighting—or, at all events, they are considering the question. I do not at the moment refer to bombardment precautions, but solely to the economic standpoint. Some members of public bodies are prepared to lend their vote for drastic measures in this direction; yet in times past, by these self-same economists, remarks have been made about the danger caused by a single automatic controller failing to act and so illuminate a roadway. Hints are given that gas undertakings do not realize their responsibility in these matters. My comments on these bodies, and on the general public, are not intended as a criticism. I am only endeavouring to explain them under the prevailing conditions.

Very little imagination is necessary for any one to realize that gas supply in war is quite a different problem from the usual running of a gas-works in normal times. A manager has very little opportunity for diversion to-day. His lot is not by any chance an enviable one. He is confronted with labour troubles with a vengeance, and, what is more, the men who are left hold the trump cards. They know it; and they are playing them solely to suit their own ends.

A New Type of Workman.

Many works are finding it almost impossible to replace with efficient men their stokers who are on active service; and in consequence men of inferior type are being engaged. With a growing consumption attendant upon manufacturers busily engaged on war supplies, the difficulty of keeping going is great. Two men have frequently to be employed to do the work of an experienced stoker. In fact, one of these men will not attempt it. This tends to give the regular stokers a somewhat exalted idea of their own capabilities; and the price of their labour rises accordingly. Anything in the way of a war bonus having been granted months ago is apparently lost sight of; for they look on this as their due, consequent on the rise in the cost of provisions. If they are not humoured in every conceivable way, good results are not forthcoming. Many managers can endorse my statement that the make of gas per mouthpiece is sadly lacking if supervision is not constant. An experienced carbonizer can tell almost for certain that a number of the retorts charged during the night shift have only had one-half of their contents withdrawn, and then been recharged. There is, nevertheless, plenty of overpulling taking place. The culprit is known to the manager; but any severe handling or remonstrance on his part would only place additional responsibility on his own shoulders. A reliable and loyal retort-house worker is at the present moment a prop to many smaller undertakings.

The high price of commodities is the pleaded excuse for the advanced rates of wage in almost every case. No one will dispute the justifiable grounds of the application; but there are very few concerns which have failed to grant some concession to assist the workmen to tide over an extraordinary period. I am inclined to the belief that the average type of workman referred to in this article does not intend to make any sacrifice in these troublesome times, if he can possibly avoid it.

Where does the trouble lie? It is not by any remote chance local. The germ of discontent has eaten its way into every corner of the British Isles. Is the attitude prevailing among the mass due to the outcome of our advanced system of education? If so, it appears that their learning has only sufficed to make them take an unfair advantage of a serious position, to the detriment of the suffering community. Education should go further—or, at all events, its results should inspire a deeper feeling of loyalty, and so strengthen our nation to bridge-over a period that will be handed down to posterity as a paramount example of a fight for liberty and freedom against great odds.

The Actual Sufferers.

There is one section of the public which receives little or no sympathy when the profit-making resources of an undertaking are practically non-existent. That section is the shareholders. Most gas companies have at least a few shareholders whose savings have been invested, and who are almost dependent upon the yield of interest for life's sustenance. These people are the real sufferers under war-time conditions. They often have no means of supplementing their reduced incomes to meet the bad days; and they, too, in common with others, have to meet the increased costs of living.

A Higher Standard of Conscientiousness Required.

One can seldom get another man to see his own faults in the same light as they appear to you. I take it we all feel that we know some men better than they know themselves. Be this as it may, the exigencies of the present situation unquestionably call for a higher moral standard of manhood from the men remaining at home. I do not for a moment infer that this applies to everybody. In fact, if each man analyzes himself he will be most willing to admit that the statement applies to others more than to himself.

An opportunity has arrived; there is a golden chance for the second-raters to become winners, if they will only put their shoulders to the wheel and keep it going. There never have been more opportunities to come out top; and the reward attendant on the results is infinitely greater than ever before. The betterment of man must come from within. The desire to conquer is a fight to be undertaken individually. Much has been said about the influence of capitalists, trade unions, the drink question, &c.; but, when all these are simmered down, it seems palpably clear that each man must plough his own furrow, and his desire to improve will best act as his own incentive.

If the second-raters would only rise to the occasion something truly great would be accomplished, anxiety would be relieved in numerous cases, and, what is more, the result would have a far-reaching effect upon our nation as a whole.

Midland Junior Gas Association.—In consequence of prevailing circumstances, the Association are this year arranging for a very much shorter programme than usual. There will be only two or three meetings for the session; and the first of these is to take place next Saturday, when there will be a short opening address by the President (Mr. F. J. Ward, of Knowle), followed by a lecture (illustrated by lantern slides), by Mr. E. Stroud, the Chief Engineer of the Holophane Company, on "Modern Illumination as Applied to Gas Lighting." At the conclusion of the lecture, the meeting will be thrown open for informal discussion.

SIXTY YEARS AGO.

From the "Journal" for Nov. 10, 1855.

Encouragement of Inventions.—We are not disposed to diminish the claims of inventors. Nay, we would even hold, with Sir David Brewster [Sir David Brewster, in a discussion at a meeting of the British Association, had maintained, not only that patents should be given gratis, but that a bounty should be paid by the Government for every invention, however seemingly fruitless], that not only ought they to have patents granted to them gratuitously, but that they ought also to be rewarded for their inventions. But we are stopped at the threshold by the practical difficulty of determining who is an inventor. Among the numerous applications for patents that are every week announced, it is quite evident, on merely looking at the titles of the alleged inventions, that in the many improvements said to have been made in the same thing, there must be several that are very similar, if not identical; and if any class of specifications be examined by persons conversant with the progressive advancements made and attempted in that particular branch of manufacture, it will generally be found that the supposed inventions are either repetitions, in ignorance of what has been previously tried and found to be useless, or else fraudulent modifications of the inventions of others. Among the many provisional specifications of inventions connected with gas lighting, for example, which appear in every number of the "Journal," we may venture to assert that very few, if strictly examined, would be found to possess much claim to novelty. Most of the inventions claimed, indeed, only profess to be "improvements" of some known apparatus or process of manufacture; and it frequently requires very nice discrimination to determine whether such improvements merit to be called inventions. Even in cases where real improvement is effected, it often happens that the advantage gained is produced by means so simple and almost self-evident, that it does not deserve to be placed in the same category with an invention depending for its successful operation on the new application of a scientific principle. In endeavouring, therefore, to reward inventors, and to encourage useful inventions, the first thing required is to ascertain whether the claimants of patents deserve the name of inventors; and, if so, what are the relative merits of their inventions. . . . What is really wanted, for the sake of inventors as well as for the public interest, is the restriction of the number of patents to those only who may deserve them, rather than an increase. When the claims of the meritorious have been ascertained by careful and impartial examination, then let the patent be granted as a reward for ingenuity and scientific acquirements, to be held in estimation as an honorary distinction, instead of being considered, as at present, merely as a purchasable commodity, procurable by any who will pay the fees.

The opening meeting of the one hundred and sixty-second session of the Society of Arts will be held on Wednesday of next week, Nov. 17, when an address will be delivered by Mr. Dugald Clerk, D.Sc., F.R.S., the Chairman of the Council. The subject of the address will be "English and German Methods Contrasted." The chair will be taken at 4.30 p.m.

On Monday of last week the death occurred, at his Newbury residence, of Sir Arthur William Rücker, F.R.S., D.Sc., aged 67. He was one of the Metropolitan Gas Referees from January, 1892, to December, 1896, having succeeded Professor Tyndall, and was followed by Professor Boys. He was President of the British Association in 1901, having previously been Treasurer for seven years. He was also President of the Physical Society from 1893 to 1895, and Secretary of the Royal Society from 1896 to 1901. Among his other distinctions was that of Doctor of Science in the Universities of Oxford, Cambridge, Victoria, Leeds, and Belfast; while Glasgow and Edinburgh both conferred on him the degree of LL.D.

We are informed that Messrs. W. A. Schultz and Co., of No. 50, Cannon Street, E.C., have opened an additional office at No. 5, Victoria Street, Westminster, for the convenience of their clients connected with statutory undertakings. Mr. W. A. Schultz, J.P., F.C.A., who is the principal, has been connected with gas undertakings for the past thirty-two years, and is well known as an expert on gas accounts. It may be remembered that he specially distinguished himself in the firm attitude he took up on behalf of several gas companies in claiming an allowance from income-tax assessments for wear and tear of gas and water plant. It was due to his unflinching position in opposition to the Surveyors of Income-Tax that he was successful in every case in obtaining a favourable decision before the Commissioners of Taxes, with the result that negotiations were opened with him and continued under the auspices of a Committee appointed by representatives of the gas industry convened and presided over by Sir Corbet Woodall, when an arrangement was come to under which the companies are at present working. It is also largely due to Mr. Schultz's initiative that many gas companies are now able to secure parliamentary powers for both gas and electricity—these having first been obtained and put into operation by the Ascot Gas and Electricity Company, of which concern he has been the Secretary for a number of years.

CORRESPONDENCE.

[*We are not responsible for opinions expressed bv Correspondents.*]

Government Scheme for the Organization and Development of Scientific and Industrial Research, 1915.

Sir,—The proposal to establish a permanent State-aided organization for the promotion of scientific research, with a view to its application to trade and industry, is a most hopeful sign of the times, and will be welcomed in principle by scientific workers generally. But, inasmuch as any such scheme necessarily implies a certain amount of State control and direction of scientific research, and ultimately also of the large body of scientific workers who will be brought within its ambit, there are certain important matters to be considered and settled in principle at the outset, if the scheme is to be as fruitful and successful as it ought to be. I venture, therefore, in the spirit of a friendly critic and well-wisher to the scheme, to submit to your readers the following paragraphs embodying some of the points which seem to me to need very careful consideration, in order that the freedom and interests of individual scientific workers shall be sufficiently safeguarded and conserved.

(1) In my opinion, what is most needful in this country for the development of scientific research in relation to industry, is a central fund for the subsidizing of a limited number of important lines of investigation initiated and carried out by scientific workers and technologists of repute who are, or have been, sufficiently in touch with practical affairs as to have acquired at first hand a real knowledge of industrial conditions, and of the economic factors, which will necessarily come into play in connection with any new development. These proposals might be initiated either by individuals so qualified or by any group or association of such individuals; and such persons should have a strong (if not a majority) representation upon any Advisory Council or Committee appointed either to select or recommend suitable subjects for investigation, or to advise in connection with the prosecution of any investigation so selected.

(2) The selection of a particular line of research should be governed by these considerations mainly:

(*a*) Its importance and practicability as directly bearing either upon the development or revival of national industries, and particularly of those which, although producing essential commodities—*e g.*, synthetic dyes or optical glass—have through past neglect become localized abroad, or which may be conceivably threatened in the near future, or upon questions pertaining to the future better utilization of national resources of raw materials—*e g.*, coal and its bye-products.

(*b*) The probability of there being a successful issue of the investigation within a reasonable time.

(*c*) The fact that its inauguration and continuous successful prosecution would involve expenditure beyond the financial resources either of an individual investigator (even though he may be aided by grants from the existing research funds of scientific and technical societies) or of the institution in, or in connection with, which he may be working.

(3) Broadly speaking, there are three distinct classes of investigation which would come within the above category—viz.:

(*a*) Investigations whose object it is to establish new or more accurate scientific data, or methods involved in the design of industrial appliances or plant, or in the daily scientific control and supervision of important manufacturing processes.

(*b*) Investigations whose object it is to effect some modifications in the details of an existing process whereby it shall become technically and commercially more efficient.

(*c*) Investigations whose object it is to convert a scientific discovery (or results which may be predicated from research in pure science) into a useful scientific invention.

(4) While all the above three classes of research are, or should be, essential features in any organized scheme for the benefit of trade and industry, the third class is undoubtedly not only the most important of all, but also the one which presents the greatest executive difficulties in procedure; and unless at the outset these difficulties are both clearly recognized and equitably met, the complete success of the scheme will be seriously jeopardized.

(5) It ought to be recognized in principle that an individual scientific investigator who may seek or obtain assistance from the central national research fund should be accorded the fullest credit and protection for the ideas which he may disclose, as also direct personal access (without having to invoke the aid or interest of some intermediary person or association) to the Advisory Council or Committee, or persons representing them, administering the fund. Furthermore, if the ideas or discoveries disclosed by him are deemed important and worthy of support, as likely to result in a useful invention, not only should the further investigation of the matter be entrusted to his unhampered direction, but also, in the event of such further investigation under his direction ultimately resulting in a useful invention, his rights and interests in the commercial results of such invention should be equitably provided for and ensured. To the objection which may be made that the acceptance by a scientific worker of assistance from a public fund for the development of his ideas or discoveries implies forfeiture on his part of any pecuniary advantage which would otherwise accrue to him, it may be replied that a scientific worker ought not to be put into a worse position in regard to the development of his discoveries, merely because he is financially assisted by the State, than he would have been had he been financed privately. It is a just and necessary principle in the development of inventions—no matter whether such development is financed by the State or by some private person or syndicate—that the inventor *quâ* inventor is as much entitled in equity to a reasonable interest in the commercial results of his ideas as is the financial power that he may invoke; and unless this principle

is conceded at the outset in connection with the Government scheme, it will never attract, or be invoked by, the scientific inventor for the development of his ideas. In short, invention and discovery, being essentially "individualistic" products, cannot flourish or be fully developed on a "socialistic" basis; and in every State-aided scheme there lurks the socialistic danger.

(6) If the above principle be conceded, there are doubtless formidable difficulties in carrying it out. Thus, for instance, it will be necessary to provide that the communication of an idea or discovery of an individual or group of individual scientific workers to an Advisory Board must not merely be confidential, but shall also confer the same sort of provisional protection which the lodging of a provisional specification at the Patent Office now confers. In the second place, should the further State-aided investigation of the matter result in a useful invention, not only ought the resources of the British Patent Office to be freely placed at the disposal of the inventor for the adequate protection of his invention, but also steps would have to be taken to ensure the same protection in all important foreign countries. For unless this were done, foreign manufacturers and countries would reap the reward of British scientific invention financed by the British taxpayer, without having to pay so much as a single halfpenny by way of royalties to the British people, and Great Britain would for ever sacrifice a most fruitful source of "invisible exports" in the shape of "British inventions." Moreover, it might easily happen that an idea or invention originating in Britain, under a Government scheme without due safeguard, might be freely imported into Germany, and, through German sources, be patented in other countries for the benefit of Germany. Such things have happened in the past under the existing patent laws, and will happen all the more in future, if the new scheme does not fully protect British scientific inventions. There thus lurks in the new scheme the serious danger of its proving an instrument and organization whereby British brains and capital will be exploited largely for the benefit of the foreigner; and while this danger may perhaps be minimized by wise foresight, it is inherent in the scheme, and it is difficult to see how it can be entirely eliminated.

(7) The foregoing considerations do not, of course, apply to the first of the three classes of investigations cited in paragraph (3); but unless they are frankly recognized and fully met at the outset, the utility of the scheme in regard to the important third class of investigation will be nullified.

The above suggestions are offered as an individual expression of opinion, which is the outcome of the writer's experience in connection with the development of his own inventions, in the hope that the final scheme will be so framed and safeguarded, in the common interests both of scientific invention and of the British public, that it may be of the utmost benefit to all concerned.

William A. Bone.

Imperial College of Science and Technology,
London, S.W., Nov. 2, 1915.

Home Sales of Sulphate of Ammonia.

Sir,—We have pleasure in enclosing copy of a circular-letter on the subject of "Home Sales of Sulphate of Ammonia," which the Association has sent out to makers, and which you will probably wish to notice in your next issue.

A. Dawson, Secretary,
Sulphate of Ammonia Association.

84, *Horseferry Road, Westminster, S.W.,*
Nov. 6, 1915.

[Enclosure.]

With reference to recent correspondence, you will remember that we held a meeting of manufacturers of sulphate of ammonia, as a result of which we offered to guarantee the Board of Agriculture a supply of 8000 tons of sulphate of ammonia for October-December delivery at a price not exceeding £15 per ton, bags free at works, net cash.

Officials of the Board had previously led us to understand that this quantity and price might be regarded as satisfactory; but the recommendations of the Departmental Committee appointed by the Board to consider food supplies and other circumstances, necessitated a change of views regarding both quantity and price. Negotiations were therefore reopened, and culminated in a joint meeting of both Committees of the Association, at which the Right Hon. Francis Acland, M.P., attended and explained the Board's views.

After a full discussion, during which manufacturers representing all branches of the trade clearly and forcibly pointed out the large increase in the costs of production, the meeting unanimously agreed that it was desirable that up to 16,000 tons of sulphate of ammonia should be reserved by makers for November-December delivery, to be sold to farmers or factors at not over £14 10s. per ton f.o r. makers' works, single bags free, net cash, for lots of 10 cwt. and upwards, and that all manufacturers making 50 tons per annum and over should be required to reserve their proportion of this quantity at not over this price. Makers who do not supply bags should allow buyers 5s. 6d. per ton.

Owing to the extraordinary conditions now prevailing, the total make of sulphate has been considerably reduced, and it is now estimated that, in order to provide a total of 16,000 tons for November-December, it will be necessary for every maker to reserve about 25 per cent. of his production—or, in other words, a little over one week's make—for each month.

Each maker will receive a letter from the Board of Agriculture which will provide him with a legally valid excuse for withholding delivery on existing contracts, in case he cannot provide his quota out of the unsold portion of his make.

Each maker will be at liberty to deliver on contracts previously made, or to sell for export or to manure mixers, at the end of each month, the unsold portion of his quota—*e.g.*, a maker whose production for November is 100 tons must reserve 25 tons until Nov. 30. Suppose farmers or factors buy from him 13 tons during November at £14 10s., the maker may, after Nov. 30, dispose of the balance of 12 tons on old contracts or sell it at market price. The same applies to December.

The Board of Agriculture is issuing immediately a pamphlet recommending farmers to use sulphate on autumn wheat; and the object of this arrangement is to provide them with sulphate at a reasonable price. Farmers will no doubt generally prefer to buy, as hitherto, through factors or merchants; and sulphate makers should therefore exact a guarantee from merchants to whom they sell that the sulphate is to be delivered promptly to the farmer.

The Board will not recognize sales for November-December delivery to manure mixers or others who intend to store sulphate to be sold in the spring as a discharge of sulphate makers' liability under the above arrangement.

The factor or merchant will be entitled to charge a fair profit to the farmer; the sulphate maker will be at liberty to sell to factors and merchants at less than £14 10s. if he so desires.

As regards spring delivery, makers are free for the present to sell at the best prices they can obtain; but it may become necessary for them to reserve for home use, in the manner explained above, a monthly quota, which may be expected to amount to about 50 per cent. of their make for January-April.

In order to cause as little inconvenience as possible to overseas buyers, makers who are largely sold are recommended to give export merchants immediate notice that they may have to curtail deliveries on contract.

Those who have already sold part or all of their make for November-December to factors or farmers for home use should give particulars in their reply to the Board of Agriculture's letter, in order to secure exemption from the above provisions.

In conclusion, we wish to say that we consider this arrangement fair to all parties. By it we avoid the calamity of a total prohibition of exports, and we provide the required quantity with a minimum of inconvenience to the export trade and ourselves. Although the price represents a sacrifice to most of us, we feel we are securing in return the best possible advertisement for our product.

We therefore ask all manufacturers to co-operate loyally to carry out this arrangement, the success of which will vitally affect the whole future of British sulphate of ammonia.

(Signed) D. Milne Watson,
Chairman of the Association.

Nov. 1, 1915.

Advantages of Sulphate of Ammonia.

Sir,—Referring to the paper I read at Liverpool last year before the Institution of Gas Engineers, I pointed out the advantages of applying to the land sulphate of ammonia combined with other artificial manures for the production of mangold wurzels, and gave several examples of experiments that have been made, the largest of which produced the following result:

Tonnage per Acre.	Value per Ton.	Value per Acre.
57 tons 10 cwt.	12s. 6d. ..	£35 18s. 9d.

Gas engineers generally will be glad to know that, by an increase of sulphate of ammonia per acre costing about 10s., the same kind of crop has been enormously increased.

The judges have again weighed the results from this year's crop, and state that the production per acre is as follows:

Tonnage per Acre.	Value per Ton.	Value per Acre.
91 tons 5 cwt. 80 lbs.	15s. ..	£68 9s. 4d.

The roots are of excellent quality; and these results have been awarded prizes in the district.

This year we have also applied sulphate of ammonia with other artificials to cabbages, which have turned out very satisfactorily—producing, according to the judge's award, the following result: 59 tons 2 cwt. 96 lbs. per acre.

For other crops on the farm, an increased quantity of sulphate of ammonia was employed, producing better and even more encouraging results than the previous year.

This is an object-lesson for some of the slow-moving farmers, whom at the present time the Government are trying to arouse to increase their crops both for their own and the country's advantage.

John West.

Southport, Nov. 5, 1915.

The Late Professor Lewes.

Sir,—As one who attended very many lectures by that Prince of Lecturers, the late Professor Vivian B. Lewes, may I express the pleasure it gave me to see, in your account of the funeral, special mention of his faithful assistant or demonstrator "Joe."

I think it may safely be said that Professor Lewes's experiments were invariably a success. There was never, in a single instance, so far as my recollection serves me, a failure. How much of this success was due to his faithful assistant, we may never know; but certain it is, a better demonstrator could not exist. Every piece of apparatus was precisely in the right place, and brought forward at the exact moment it was required. Never a moment to wait—never the slightest confusion—never an experiment which did not "come off."

Gas Engineer.

Nov. 3, 1915.

Gas Company's Show-Rooms.

Sir,—The suggestions by Mr. Cyril G. Davis in your last issue, of how a show-room should be designed, fitted up, and conducted, should be most carefully read by all interested in this important subject. We in the North, certainly, have all three sorts—viz., good, bad, and indifferent.

I agree that show-rooms should not be expected to show a direct profit; but, when conducted on thorough lines, they are undoubtedly one of the best forms of advertisement.

Any who are contemplating show-rooms, or are bringing present ones up to date, would do well in sending those who are directly responsible to see the Davis Gas-Stove Company's most elegantly designed and furnished show-rooms in Oxford Street.

I congratulate Mr. Cyril Davis not only for his most opportune article on this really important subject, but also for the splendid arrangements achieved by his firm in this direction, and for which I understand he has been chiefly instrumental in having had carried out. I also congratulate the firm upon their courage in such rapid advancement.

WILLIAM D. HELPS.

Leeds, Nov. 6, 1915.

SIR,—May I as a gas engineer be permitted to express my appreciation of Mr. Cyril Davis's excellent article upon show-room reform, which you in your leading article have so ably supported?

Mr. Davis has, without doubt, written upon a subject which behoves many gas managers to study. I would not venture to give an opinion upon the matter had I not visited the salons in Oxford Street, and compared them with the different show-rooms of various gas companies in other towns. The latter have impressed me mostly with their dirty and untidy appearance; their inartistic posters on walls; lop-sided fittings; and bad ventilation. What must be the opinion of consumers after leaving such depressing places? I would not like to express an opinion of the salesmen or those in charge; but it is obvious there is room for improvement without incurring additional expense.

Mr. Davis has evidently placed before us facts of his own experience; and I suggest that his pioneer article should do much to remedy the existing state of affairs and rouse the gas industry to a full sense of its show-room responsibilities.

JOHN MITCHELL.

New Southgate, Nov. 6, 1915.

Gas Testing in the City of London.

SIR,—I have just had my attention called to the announcement in your "Personal" column of the last issue of the "JOURNAL," and would feel obliged by your correcting the same in an early issue. The fact is that I am simply taking charge of the City Gas Examiner's Office, and the testing places, under the instructions of the Chairman of the Committee for County Purposes, pending any arrangement that may be made by the Court of Common Council.

W. W. DUFFIELD.

Lower Whitecross Street, E.C.,
Nov. 6, 1915.

REGISTER OF PATENTS.

Preliminary Cooling of Incandescent Coke.

WALCH, W., of Düsseldorf, Germany.

No. 17,236; July 21, 1914. Convention date, Nov. 3, 1913.

The inventor proposes to make use of a method of cooling coke (from coke-ovens) which is based on the recognition of the fact that it is possible to deprive the coke of heat by means of gases which prevent combustion and are caused to pass through the incandescent coke—inert gases.

To enable large quantities of heat to be taken up in this manner, the patentee remarks, it is necessary to cause large quantities of gas to pass through the incandescent coke, which involves the expenditure of considerable work on the centrifugal blower, while, unless arrangements are made to employ cheap gases, the method would be rendered unprofitable. The cheapest cooling gases which can be employed for the purpose are the products of combustion of heating plant, and more especially the products of the coke-oven itself, as they escape from the heating passages. The large amount of work required for the centrifugal blowers is balanced by the fact that the method in question is combined with useful heating processes by means of which the heat taken up by the gases during the cooling of the coke can again be beneficially utilized—it may be, in the operation of heating the coke, or it may be for the production of steam or the preliminary heating of air or the like. For various reasons it is advantageous, he says, to cause the inert gases to move in a closed circuit in such manner that they take up heat from the incandescent coke and then again part with the heat to heat-exchanging or heat-consuming apparatus. The use of a closed circuit, it is claimed, has the advantage that the inert gases, when acting as heat-conveyors, will very soon lose the last remnant of their oxygen by combustion; while, moreover, the only loss of heat which can occur in a closed circuit is that due to radiation. The heat of the coke is thus taken up by means of a current of inert gas, whereby it is transferred to a heat-exchanging apparatus—the inert gas preferably consisting of the combustion products such as the heating gases of the oven.

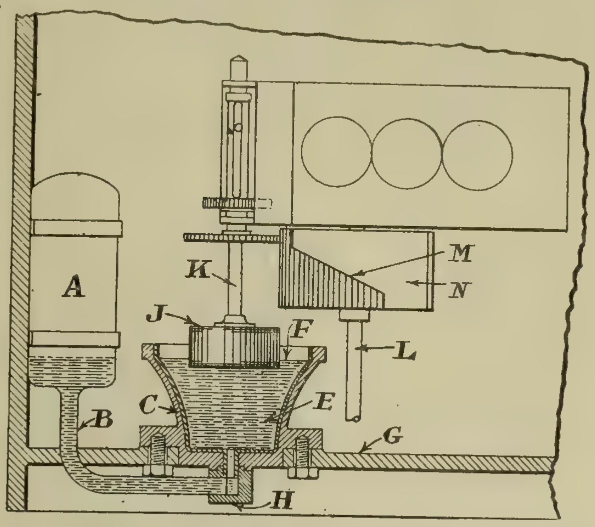
Measuring or Regulating the Flow of Gases or Recording Changes of Pressure or Temperature.

MARSH, R. G., of Birmingham, and WALTER, C. M., of Four Oaks, near Birmingham.

No. 22,687; Nov. 18, 1914.

In explanation of their invention, the patentees remark that, for the purpose of compensating for the variation of the volume of any gas being measured, caused by differences of pressure or temperature, it has been proposed to employ a vessel containing air, which will vary in volume in the same ratio as does the gas, with a stem from the vessel formed into a U tube containing mercury, which will alter its level in the outer arm as the air in the bulb expands and contracts. This movement of the liquid it was proposed should be utilized by employing a float upon it for moving a compensator rod controlling an intermediary conical wheel or integrator in a recording train, to which motion is given by the gas to be measured. They are not aware that this principle has ever been successfully carried out commercially for gas-meters or for pressure-recording or indicating devices—possibly due to the fact that the movement of the float for any increases of pressure, while relatively large at first, becomes considerably less as the pressure increases, until the movement becomes so small as to render it almost impossible for compensation devices in the recording mechanism to operate.

The particular object of the present invention is to overcome this defect and enable pressure change indicating devices of this character to be brought into practical use. They employ as a float chamber an enlargement of the liquid tube leading from the hermetically closed air or gas containing vessel and gradually restrict the area of the vessel by curving its walls converging inwardly—the curve being calculated so that its relative area at the lowest part to which the float may go to the area at its highest part is such that, for any increment of pressure, an equal movement of the float is obtained. The arrangement is of particular value when applied to the purpose of compensating or correcting a recording gas-meter for variations in pressure. For high-pressure meters of the self-correcting type it is said to be of great utility; and in the following description the invention is described as applied to this purpose.



Marsh and Walter's *Self*-Correcting High-Pressure Meter Mechanism.

A part sectional elevation is given, showing the vessel and shaped float chamber embodied in, and connected up to, a known form of compensating gear.

The gas or air containing chamber A comprises a closed vessel (preferably of glass or other non-porous material, or a metal chamber lined with non-porous material) from which a tube B is lead to a float chamber C; so that the mercury has free communication between A and C. The latter chamber may be circular in cross section, and is then formed with all its surrounding wall surface gradually curved—the curve converging inwardly so as to cause a gradual diminution of the area of the chamber from the upper part downwardly. The curvature is calculated so that the relative area of the chamber at the lowest part to which the float may go (marked E) to the area at the highest part (marked F) is such that for any increment of pressure of the gas an equal movement of the float is obtained, notwithstanding the increasing resistance of the contained air or gas in A.

The float is directly connected to mechanism which is the subject of patent No. 12,668 of 1910. The chamber C is secured to a base G, and the pipe B is separate from the chamber and connected by a union H. The float J is connected directly to the vertically slidable countershaft K of the 1910 patent mechanism, which countershaft is parallel to the meter spindle and carries a gear-wheel for transmitting motion from the spindle to a train of the registering mechanism. L is the spindle to which the meter spindle is connected, and M is the toothed compensating wheel of the patent mechanism. But whereas in the prior patent the movements of the device sensitive to pressure changes were transmitted to the countershaft K through a lever whose fulcrum was between the device and the countershaft, the motion of the shaft was therefore opposite to that of the device now illustrated, in which the shaft and the float J work together, so that the arrangement of the plane space N in the wheel M must be the reverse of that in the earlier patent.

Destructive Distillation of Coal.

WELLINGTON, S. N., of Mincing Lane, E.C.

No. 20,457; Oct. 2, 1914.

This invention has for its object to provide a furnace-setting in which vertical retorts are used whereby the heating of the retorts is effected with a view to the uniform application of heat, and to the precise adjustment of temperature according to the temperature conditions of distillation required.

A vertical section of the setting is given on p. 326, taken transversely through the retorts; also a vertical section taken through the flues between the retorts, and a vertical section of the setting taken along the major axis of the cross-section of a retort.

The retorts are of oblong section, gradually flaring outwardly towards the bottom. They are narrow, so that the heat applied on the broad faces of the retort may quickly penetrate the charge within. Each series of retorts is mounted between transverse walls, and between adjacent retorts and between the end retorts and the enclosing wall of the setting are a number of horizontal partitions, which serve to form separated heating chambers extending across the lateral faces of the retorts. Each of these heating chambers is supplied with preheated gas from a gas pipe or conduit C, which extends to the face of the outer wall of the setting, where cocks are provided by which the supply of gas may be opened or closed. The heating chambers are adapted to operate in pairs; and the heating chambers of each pair on each side of the retorts communicate at the end opposite to that at which

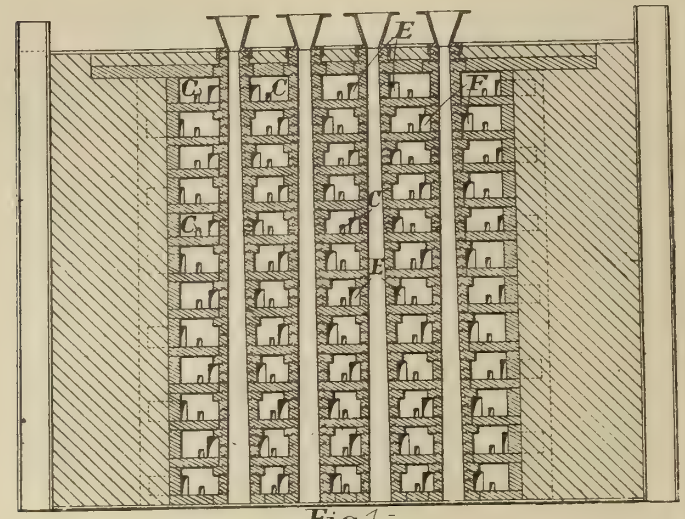


Fig. 1.

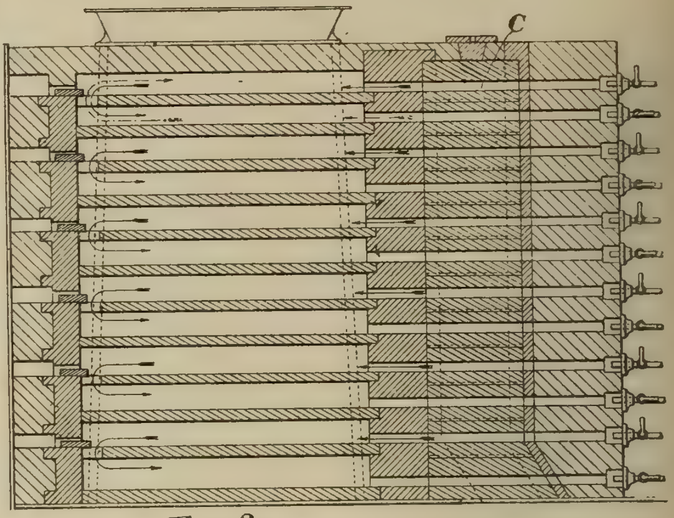


Fig. 2.

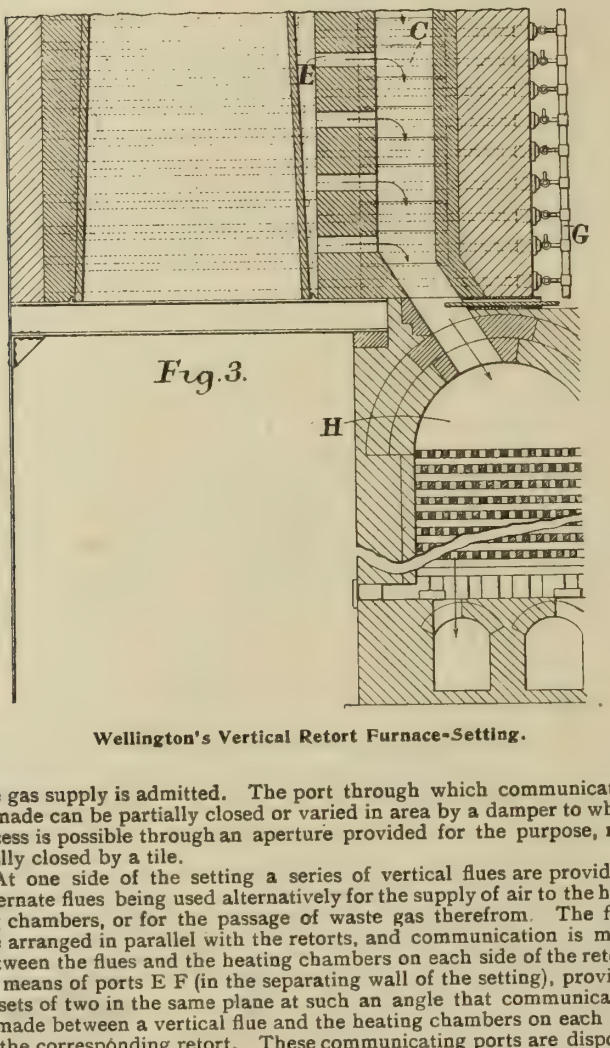


Fig. 3.

Wellington's Vertical Retort Furnace-Setting.

the gas supply is admitted. The port through which communication is made can be partially closed or varied in area by a damper to which access is possible through an aperture provided for the purpose, normally closed by a tile.

At one side of the setting a series of vertical flues are provided; alternate flues being used alternatively for the supply of air to the heating chambers, or for the passage of waste gas therefrom. The flues are arranged in parallel with the retorts, and communication is made between the flues and the heating chambers on each side of the retorts by means of ports E F (in the separating wall of the setting), provided in sets of two in the same plane at such an angle that communication is made between a vertical flue and the heating chambers on each side of the corresponding retort. These communicating ports are disposed in alternate series, so that in one plane—that is, in the plane of the uppermost heating chamber of each set on each side of a retort—the ports E communicate with one vertical flue; while the second and communicating heating chamber communicates with the adjacent flue by the ports F, and so on. Thus the second heating chamber of each set on each side of the retort receives air through the first flue, and discharges the waste gas into the second flue; or the order may be reversed according to the conditions of working. Accordingly, when air is admitted to the first heating chamber of each set gas will be also admitted; while the gas will be cut off from admission to the second heating chamber of each set until the order of working is reversed.

Gas is supplied from a service pipe G extending the length of the setting in a position adjacent to the respective gas-cocks; and each alternate gas-cock may be connected to a common operating rod or chain, or be otherwise connected so that the cocks of each alternate series may be separately operable for reverse working.

The gas-conduits C are provided in the partition walls I serving to form the several vertical flues, as by such an arrangement the gas supply is preheated before it reaches the heating chambers by the absorption of heat from the waste gases passing down the flues.

The regenerator H (formed below and to the side of the retort setting) is divided by walls, which may be extensions of the partition walls, into compartments corresponding in number with the vertical flues—each compartment being filled with a mass of material capable of absorbing heat from the waste gases. Dampers are provided to control the communication between the regenerator compartments and the vertical flues. Below the regenerator are two parallel flues opening at one end to the atmosphere or to a source of air supply and connected at the other end to the chimney or other waste-gas exhaust. Passages are also provided to effect communication between the flues and the compartments of the regenerator. At each end of each flue is a valve or damper, by which the operation of one of the flues as an air supply and the other as a waste-gas outlet is controlled and reversed—that is to say, one set of valves or dampers being closed and the other set open, one flue acts as the air supply and the other flue as the waste-gas outlet, and *vice versâ*, with the result that a reversal of flow of the air and gas in the regenerator and heating chambers takes place. The operation of the valves or dampers may be effected periodically and automatically by such means as electrical time controlling gear, which may also be employed to control the gas-supply cocks.

Carburetting Water Gas.

Porges, P., and Strache, H., of Vienna.

No. 1329; Jan. 27, 1915. Convention date, April 27, 1914.

As is well known, the patentees point out, water gas has been carburetted hitherto by decomposing oil vapours by high temperatures into gaseous hydrocarbons, which were mixed in their nascent state with the water gas. The continually rising prices of the carburetting oils—due not only to their extensive use for the generation of water gas, but also to their being used at present to a large extent for working Diesel motors and other heating purposes—has rendered the use of carburetted water gas unprofitable, because at the present time its price is greater than that of coal gas. In the same way as the prices of the carburetting oils, the price of benzene has also risen continually, because a very large amount of benzene is consumed owing to its extensive use for driving motors—more particularly for automobile purposes. Various processes have already been proposed for producing hydrocarbons of the benzene type, by the destructive distillation of mineral oils, whereby the higher hydrocarbons of the heavier oils are split-up into lower hydrocarbons by heat, with or without the use of a catalyzer, and in some cases with simultaneous use of steam.

The carburetting of water gas according to the present invention consists in splitting up the carburetting oil by destructive distillation in such a manner as to produce hydrocarbons of the benzene type, "with the simultaneous production of considerable quantities of heavy oil gas of great heating power." For this purpose a mixture of oil and water vapours is passed over heated iron oxide or over cast iron that was previously superficially oxidized, whereby the oil vapours are decomposed into oil gas, benzene, and heavy hydrocarbons. From this heavy oil gas the benzenes are separated by condensation in the usual manner, and the oil gas is added to the water gas for carburetting it.

The catalyst (iron oxide or oxidized cast iron) employed for the decomposition of the mixture of oil and water vapours may be brought into the regenerators under hot carburation. The regeneration of the catalyst, which is reduced in the destructive distillation and is covered with a layer of coke or tar, is obtained in the regenerator itself during the blowing period by the addition of tertiary flow of air. The destructive distillation then takes place (in the manner referred to) in the regenerator during the gas period, whereby the oil gas that is formed mixes with the water gas or the like.

The residue left by the destructive distillation, and which contains tar as well as the substances that could not be decomposed by destructive distillation, may be used in the ordinary way like other carburetting oil for carburetting purposes, or the residue is utilized for firing the apparatus in which the destructive distillation is effected.

The yield in benzene is said to cover almost the entire cost of the carburetting oil; "so that the carburetting of water gas can be effected without cost by means of the oil gas produced in the destructive distillation."

APPLICATIONS FOR LETTERS PATENT.

15,040.—Gallimore, A. V., "Locks for taps." Oct. 25.

15,129.—Connolly, P., and Logan, J., "Globes for inverted burners." Oct. 26.

15,322.—Ionides, A. C., "Furnaces." Oct. 30.

Mr. W. R. Twigg, the Technical Manager to the Davis Gas-Stove Company, Limited, of Luton, has recently been elected a Fellow of the Chemical Society.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Lighting of London during Fog.

Lord SYDENHAM asked whether organized arrangements had been made to increase the illumination of the London thoroughfares in case of fogs. He pointed out that the distance between street lights was now two or three times, and in some cases four times, as great as it used to be; while the lamps that were lighted gave only about a quarter of their usual light. With comparatively mild fogs, the streets, under these conditions, would be dangerous; and though it would be mpossible to put up temporary lighting for all the streets of London, he thought it would be feasible to have extemporized arrangements to give light to the principal arteries upon which the traffic depended.

Earl CURZON, in reply, stated that, under the new lighting regulaions, the provision in the earlier order that, while thick fog prevailed normal lighting of the streets might be resumed, was omitted; but the effect of it was retained by the paragraph which empowered the Commissioner of Police to give any necessary instructions for this purpose. The following were the principal measures adopted for dealing with the problem: The lighting of side streets was being increased by bringing more lamps into general use, so far as this could be done consistently with the general scheme to reduce lighting in the London rea; and in some parts of London the number of lamps in use every ight would now approximate to three-quarters of the normal. The act that the lamps were shaded, of course, reduced their normal illuminating effect. A number of lamps which were not in use on clear ights would be lit in case of fog, where the system of lighting and other conditions rendered this practicable.

HOUSE OF COMMONS.

Finance Bill.

Clause 35 of this Bill, relating to trades and businesses to which the xcess profits duty applies, was considered in Committee by the House last Wednesday, when Mr. LOUGH moved to exempt municipal authories from the tax.

Mr. M'KENNA, in the course of his reply, said that Parliament had lready decided that the profits of municipal undertakings should be ubject to income-tax. Municipal undertakings were in many cases irectly competing with other concerns, in which private individuals ad invested their money, and from which they might reasonably look or a fair return. He did not, therefore, feel justified in asking Parliament to come to a different decision.

Coal Mining Industry and Enlistment.

In the House last Thursday, Mr. MILLAR asked the Under-Secretary of State for War whether the names of men of military age engaged in the coal mining industry have been starred as engaged in work essential o the successful prosecution of the war?

Mr. TENNANT: This matter is engaging the attention of the War ffice. In many cases the coal miners have been starred; but all ssential and starred men who may be enlisted will, after enlistment, e returned at once to their civil employment pending inquiry.

LEGAL INTELLIGENCE.

THE RATING OF WATER-WORKS.

Chertsey Union v. Metropolitan Water Board.

In the House of Lords, before Earl Loreburn, Lord Atkinson, Lord arker, and Lord Shaw, judgment was reserved on Monday of last eek in an appeal by the Metropolitan Water Board from a decision of e Court of Appeal dated March 8, which affirmed the judgment of the King's Bench Division on a special case stated by the Court of uarter Sessions for the County of Surrey.*

The respondents to the appeal were the Assessment Committee of e Chertsey Union; and the question between the parties was as to e rating of an intake from the River Thames, canal, pumping-station, nd premises situated in the parish of Walton-on-Thames, and owned nd occupied by the appellants. The rate in question was made in ay, 1912; and the premises were assessed at a gross estimated rental £15,810, and at a rateable value of £10,550. The appeal by the Water Board to the Surrey Quarter Sessions resulted in getting the sessment reduced to £11,677 and £7785 respectively, subject to the igh Court affirming the assessment on the special case stated. The Water Board had, under various Acts of Parliament, acquired a right take water from the River Thames upon payment to the Conservars of certain sums of money. In pursuance of this right, they ceived at their pumping-station and premises at Walton the flow of ater from the Thames over a piece of land on the river bank in their cupation called an "intake." It was not disputed that the intake, orks, pipes, pumping-station, &c., were liable to be rated to the relief the poor; but the Water Board claimed that the intake ought not be rated beyond its structural value and its value as land. The main estion was whether the intake was liable in an additional sum as ving an enhanced value by reason of its fitness for the use made of in taking water from the river. Another point raised was that, being statutory body, the Water Board were able to borrow money at 3 or 3½ r cent. per annum, and therefore the Quarter Sessions wrongly considered themselves bound in fixing the assessment to take the ordinary rate—namely, 4 per cent. on the purchase value of the land, and 5 per cent. on the value of the works—without considering the special circumstances of the present case.

The Divisional Court held that the intake had an enhanced value; and, further, that, although the Water Board could borrow at less than 4 per cent., there was no reason to depart from the usual practice adopted by Assessment Committees in assessing hereditaments, of taking 4 per cent. on the purchase price of the land and 5 per cent. upon the cost of the buildings. The Court of Appeal agreed with the Divisional Court that the case must go back to Quarter Sessions to add the additional assessment to the value of the intake, on the ground of its enhanced value by reason of its fitness for user; and also held that the basis of calculating the value of the land and premises was right, and must be affirmed. The Water Board appealed.

Mr. RYDE, K.C., and Mr. JACQUES ABADY [holding the brief of Mr. H. FLETCHER MOULTON, serving with H.M. Forces] appeared for the Water Board; Mr. PAGE, K.C., Mr. W. W. MACKENZIE, K.C., and Mr. LAWRENCE TOOTH [holding the brief of Mr. H. CONACHER, serving with H.M. Forces] represented the Chertsey Union.

At the conclusion of the arguments, which were heard on Oct. 26, 28, 29, and Nov. 1, judgment was, as already stated, reserved.

A Claim for Glassware Supplied.

A disputed account between Messrs. Hurst and Co., glass manufacturers, of Farringdon Road, and Messrs. William Sugg and Co., Limited, of Regency Street, S.W., was the subject of an action heard last Friday by Mr. Pollock, one of the High Courts Official Referees. Mr. Macaskie, appearing for the plaintiffs, said that the claim was for £97 17s. 8d., the price of glass fittings delivered to the defendants in June and July, 1914. The defence to the claim was that, by writ of the King's Bench Division, plaintiffs claimed £1514 in respect of goods sold and delivered; and in the result plaintiffs accepted the sum of £1450 in satisfaction. The goods forming the subject of the present claim, the defendants said, were included in the previous claim which had been settled. The plaintiffs replied that the goods making up the present claim were not included in the £1514 claim which had been settled. Mr. Latter (for the defence), in reply to the Official Referee, said his position was that the payment made in settlement of the former action more than covered defendants' indebtedness for everything. If the amount paid more than covered what the plaintiffs could make out was due without the £97, then everything had been paid. The Official Referee said that the claim of £1514 was settled for £1450. A compromise was a compromise, and did not show which way the balance was. Mr. Macaskie said the £97 17s. 8d. was in respect of four orders in the month of June, and the deliveries were made in July. When the plaintiffs went over the books after the settlement, they discovered that there was no entry in their ledger of the four items which went to make up the claim in the action. The omission was owing to the fact that plaintiffs were re-constructing their system of book-keeping at the time. The Official Referee remarked that the case resolved itself into the question whether the items claimed for now were included in the original £1514; and it was for the defendants to make out that it was so included. Mr. Latter said that they certainly thought the compromise related to everything supplied at the particular date. In arriving at the settlement the defendants had taken into account all the invoices delivered. The Official Referee, in the result, found that the defendants had failed to show that the items claimed for were included in the settlement of the previous action. There would therefore be judgment for the plaintiffs with costs.

Sequel to an Accident at a Manchester Gas-Works.

A case under the Workmen's Compensation Act was heard at the Manchester County Court, by Judge Mellor, K.C., on Monday of last week. The applicant was Frank Hall, aged 15, a picker, employed at the Bradford Road Gas-Works of the Manchester Corporation; and it was stated that on the morning of June 9 last, while he was, by his foreman's express instructions, pushing coke down a feeding-hole with a long-handled rake, the latter slipped and caught his legs. He was pulled forward; and his right thigh was so badly injured that he had to remain at a Manchester institution for about ten weeks. In cross-examination, applicant said he knew it was the rule of the works that boys should not go near the crusher where the accident happened; but he had to obey the orders of his foreman, when he told him to push the coke down the crusher. Frederick Owen, the foreman from whom the applicant said he had received instructions, denied that he gave any such order. There was a rule, he said, that boys were not to go near the crusher; and he had himself on four or five occasions warned Hall away from it. At the Infirmary, Hall admitted that it was through his own fault that he had been hurt. Witness would get into trouble both with the Corporation and with the Gas-Workers' Union if he set the lads on to feed the crushers. Additional evidence was given that boys were not allowed near the crushers, and that on the morning of the accident Hall had been called from this particular crusher by another workman. The Judge decided in favour of the respondents, with costs.

United Gas-Works Development Company.

On Friday, Mr. Hilyard applied to Mr. Justice Sargant, on behalf of debenture holders, for the appointment of a Receiver in the case of the United Gas-Works Development Company, Limited. He said the the Company had passed a resolution for winding-up [*ante*, p. 282], which made the debentures at once payable; and there was also a case of jeopardy. He did not ask for a Manager, as the Company were not now carrying on any business. Mr. Johnson for the Company, and Mr. Owen Thompson for the Trustees of the debenture deed, did not oppose the motion. All parties were willing that the motion should be treated as the trial of the action, and a final order now made. His Lordship made an order for the appointment of a Receiver, with liberty to him to act at once.

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* See "JOURNAL," Vol. CXXII., p. 189; Vol. CXXVI., p. 513; and ol. CXXIX., p. 679.

MISCELLANEOUS NEWS.

EVIDENCE ON FACTORY LIGHTING.

There is now given the fifth, and final, instalment of extracts of more particular interest to "JOURNAL" readers, from the evidence given by various witnesses examined by the Home Office Departmental Committee on Lighting in Factories and Workshops. Previous notes of the inquiry will be found on pp. 98, 149, 209, 273. The principal witnesses dealt with to-day—from the gas engineering point of view—are Messrs. A. J. Whyte and J. Angus, of the James Keith and Blackman Company.

Mr. *Percy J. Waldram*, F.S.I., a member of the School Lighting Committee of the Illuminating Engineering Society, said he thought a mixture of artificial and natural light was deleterious. He believed the majority of doctors and physicians were of this opinion. During the last five years, he had noticed a distinct rise in the amount of artificial illumination which people required, and which they would stand. Of course, some years ago the good lights of the present day were not available. It was more or less a question for a doctor to decide whether it was possible for a person to carry on any trade continuously under artificial light only without his eyes suffering. Personally, it would seem to him to be a very doubtful matter indeed. It was the doctor who would not give them the information needed. They wanted the doctors to say how many hours people could work in artificial light.

Mr. *W. M'Dougall* expressed the opinion that it was extremely difficult to carry through any laboratory experiment from which, if a definite result was secured, one could safely infer working conditions. Any experiment on which reliance was to be placed ought to be under ordinary workshop conditions. Asked, on the subject of glare, if there were any means he could suggest to the Committee for discovery whether exposure to strong light for some time during the progress of work was necessarily harmful, witness replied that he thought this was a problem which one could investigate in a general way under laboratory conditions; but it might be a very prolonged and difficult experiment. One would almost be bound to drive the experiment to the point at which some slight injury might be done; and this there was naturally unwillingness to do. Here, again, he could only suggest the alternative of collective workshop experiments.

The CHAIRMAN: We have had a case where it is possible, I believe, to have some experiments carried out, if we can devise them. Women are employed in an electric lamp factory testing the lamps; and they do this all day long by turning the current on to a series of lamps, glowing the lamps perhaps not to the maximum brightness, but very brightly, and examining each lamp. Some of these women have been engaged in the work for several years; and they say their eyesight is still as good as ever. Is it possible to verify this in any way?

Witness: I do not see how you can. I am not at all surprised to hear it. I myself should not in the least expect any injury to the eyesight. I should expect any injury there might be to be seated deeper—namely, in the brain. Probably a general kind of injury might be done without any possible effect on the eyesight. That is to say, I should expect that any condition of strain which is continuing day after day and week after week would tend on the whole to run-down the worker, and perhaps to produce a neurasthenic condition, which is one of the general symptoms, and one not easily measurable in definite terms, especially at the lighter stages. I should expect the injury to cause general diminution of efficiency, rather than to be local.

I suppose what you say as to the effect of glare causing no actual injury, but merely a lowering of general efficiency, applies also to the strain which one would get, not from glare, but from insufficient lighting. There, again, I suppose, the results would be general rather than specific?—I think so.

Mr. GASTER: In the United States, the illumination in a large number of factories has been improved; and 30 per cent. show better quality and more output. When they made these experiments of increased illumination, they found an increased output and better quality. This increase continued for a certain period; and then there was a further increase. Then there comes a point where there is no increase, and, in fact, there is a diminution. What would you consider the right amount? Is it the amount where the increased output reaches its highest point, or is this not satisfactory? If you are going to prescribe the minimum amount which is permissible for the workers, at what point do you think you should stop?

Witness: If I understand your description of the experiment, I should have very great confidence in inferring that the best amount of illumination was that corresponding to the top of the curve. I do not know whether I am going beyond my scope if I suggest that rather than prescribe a minimum, the desirable procedure is to bring out the facts, and say: "Here is your maximum efficiency, if you do that." This ought to make prescribing of a minimum unnecessary.

Dr. Young has made experiments as regards fatigue; and he tried the intrinsic brilliance of different sources—incandescent gas and the arc lamp. If you get the operator to look at the incandescent light, it takes a few seconds before he is capable of seeing his work. He found the time it takes is ten times greater in the arc than it is in the ordinary incandescent; and he says this has a lot to do with the amount of comfort of the work?—I should think that is one of the factors of glare.

Would that be a useful way to determine it?—No; I do not think you can rely on the after-image, because, after all, even with an experienced observer, the after-image is very apt to disappear, and then suddenly pop up again through various slight causes which you cannot account for.

Dr. *H. Kenwood*, Medical Officer of Health for the County of Bedford and the Borough of Stoke Newington, said that in his experience artificial lighting in factories was often defective. This was much in evidence at the present time. The worst conditions were to be found in small workrooms, home premises, underground bakehouses, and places of that kind. He would say that no room ought to be used as a workroom in which there was not some daylight; and he would go so far as to urge that no room should be so used in which there was not enough daylight on suitable occasions to enable the work to be carried on. He based his objection to the exclusive use of artificial light on psychological grounds, as well as on the matter of eyesight. If the artificial light was really good, the eyesight should not as a rule suffer materially. Then it was more the physical health that suffered. No one should be allowed to work continuously, by day and night, by artificial light alone, under any conditions.

Dr. *F. R. Cross*, a member of the Council of the Royal College of Surgeons, President of the Ophthalmological Society, and Vice-President of the Ophthalmic Section of the Royal College of Medicine, stated that he had sent to members of the various ophthalmic societies a letter asking for facts "with regard to the occurrence of slight, as well as more serious, ailments of the eyes that may be due to insufficient lighting of factories and workshops." The replies received did not indicate that definite eye troubles were commonly caused by defective lighting of workshops. Out of about 300 replies that he received, nine-tenths were negative so far as regarded any information his correspondents had of damage done to the eye by imperfect lighting conditions in factories and workshops. It was a very unsatisfactory condition of things where all work had been done by artificial light. He did not think the human eye was intended to work for many hours by any form of artificial light that could be conceived. Where local lighting was required, it should be sufficient, and not excessive. It should be specially adapted for particular conditions, to illuminate the work or machinery without irritation to the eyes. There should be an avoidance of glare, flickering shadows, and of separate side-lights falling on the retinæ and pupils of the workmen. The rays emitted should be luminous, with, as far as practicable, avoidance of heat and of ultra-violet rays.

The CHAIRMAN: You say that defective lighting is unsatisfactory for work, causes eye and brain fatigue, headache, and giddiness. We have had it more or less in evidence here that probably defective lighting would show itself in this kind of way, rather than in obvious damage to the eye. Would you agree to that?

Witness: Yes, I think so. It seems to me that the brain would be dissatisfied with the illumination, rather than that any tissue damage would be done to the eye.

One witness has raised the question whether mixed lighting—that is to say, partly artificial and partly daylight—was very seriously disadvantageous or not?—I should think, unless it is very well done, it gives unsatisfactory sight conditions. Probably, for a satisfactory combined lighting, you ought to have an excessive amount of artificial illumination.

Replying to further questions, witness said that for general purposes of purely artificial illumination, although a good "direct" lighting may seem easier of application over certain limited areas of working, he considered "indirect" lighting by reflection a more scientific method under most conditions. With regard to the question of glare, he did not think there was any evidence of this being really deleterious; but it must obviously be unsatisfactory to have half a-dozen lights throwing different colours on the retina. He agreed that really the only definite injury was from excessive lighting; but if this excessive lighting did do damage, there must be conditions of less degree that were likely to do a certain amount of damage not so apparent.

Mr. *A. J. Whyte* and Mr. *J. Angus*, representing the James Keith and Blackman Company, Limited, then gave evidence; pointing out, in the first place, that the firm made it a rule to keep up the standard of lighting as high as possible, chiefly on account of the fact that they could afford to give an abundance of light, because they could provide it so very cheaply. Further, it had to be borne in mind that maintenance of lamps and fittings was not always attended to; and an allowance had therefore to be made for deterioration of light through this cause. They stated, however, that the light should not be allowed to deteriorate by more than 15 per cent. at any time; and in any contracts of which they undertook the maintenance, provision was made accordingly. To show how the methods adopted by the firm had worked out, a set of tables was submitted giving comparative information and tests regarding several factories. The tables indicated differentiation between general lighting and bench or individual lighting. It was explained that it had been the practice of the firm up to now, in undertaking lighting installations, to take into account the following factors: (1) Where plans had been submitted, they had been careful to get as many particulars as possible of the requirements of the trade, class of work carried out, position of benches, fixtures, machines, &c., and provide for these, in accordance with their experience, lights either on the general or on the individual principle. (2) Where no data had been available, as in the case of dealing with new factories, and they had been asked to provide a lighting scheme, it had only been possible in these cases to allow for a general illumination, which they had calculated for and provided, having regard to the superficial area of the building and the class of trade. For instance, they knew from experience that an allowance of from 1 to 1½ foot-candles per superficial foot would give an excellent result on a working plane approximately 3 feet above the floor. It was obvious, of course, that this calculation was only possible when the total candle power of the lights, together with their height from the floor level, was taken into consideration. Their experience, however, had led them to know at what approximate height certain candle-power fittings ought to be fixed, having regard to the conditions of work in the factory. They had given more, and sometimes less, than this standard on many occasions, according to the conditions of the trade and requirements of customers, and or occasion of competition. This was not stated as a definite standard for calculating the illumination required for any given factory or trade as it was a rough-and-ready method, which, however, worked out very well in practice, if used with common sense, and with previous experience to go upon. (3) In dealing with existing factories, the question had been very much easier, as everything was open to them, and inspection of the factory being made enabled them to provide the required light for the particular work to be carried out, whether it wa individual or general; and this system was one that had never failed provided subsequent maintenance was reasonably attended to. It wa generally considered that a result of from 2 to 3 foot-candles would b ooked upon as adequate lighting in most trades. Regard was had, of course, to the provision of the deep or flat shades, in accordance with the work done in any particular trade. For general lighting, where the fittings could be placed well out of range of vision, they usually employed what was called their flat shade, which, of course, gave a better distribution. For bench lighting, and for individual machine lighting, as well as compositors' desks, they found that much better results were given by the provision of deep shades. At all times, of course, the elimination of deep shadows was kept in mind. This was a simple matter with general lighting; but where the whole of the lighting was individual or bench, then the provision of a few lights of a general character here and there overcame any dense shadows that might result.

The Chairman: As to the figures that are actually given in the tables. In the first case, shopfitters, machine saws, and setting-out. You say the readings run from 6·5 to 5 foot-candles, on the working plane. Do you know at all how the workmen approved of that?

Mr. *Whyte:* I know personally they were delighted.

I notice in the joiners' workshop the amount is something under 4 foot-candles, which is a good deal less. The first room requires appreciably more light than the next?—That is partly on account of the fact that the illumination was kept up because of the amount of dust. Then, again, the whole endeavour has been to utilize general lighting as much as possible in that factory, and to eliminate the individual lighting, thereby lessening the number of lamps, and simplifying and cheapening maintenance.

Then we come to a tin-box manufactory. I suppose we may take t that for this work 3½ foot-candles is quite good?—It is quite good.

In a motor-car works, the theoretical illumination is rather lower than you told us you generally made. The minimum goes down to as low as 0·6 foot-candle. Is that sufficient in a shop of this kind?—That was adopted in severe competition with electric light. While going over the factory, I noticed half-a-dozen small units of light had been put up since the job was carried out—over saws and places where there was a shadow cast by the man's body. As a result of the installation, we have had another 40,000-candle power contract in a big extension, which indicates approval of the scheme.

Then there is a biscuit factory. Do you know why mixing and ovens require very much more light than packing and cutting? With the cutting-room, you have 1·4 foot-candles as the mean; and in the mixng, 4 foot-candles. Is there something in the work which requires a different illumination?—Yes.

As to the skirt manufacturers. Is the amount of light you usually supply for sewing-machine work something from 7 to 9 foot-candles?—Yes, depending on whether the work is light or dark.

In the boot factory, the first mean reading is 35 foot-candles. This s a very special case?—Yes, the light is flooding down on the needle-point of the sewing machine, but is out of the eye of the operator. The work performed is on black uppers of boots.

Now we come to an engineering works. Here, again, on the fitters' benches and the machines you seem to go for something of the order of 3 to 5 foot candles. Is that your general experience?—In this case the readings are high; but we received instructions to give plenty of light.

In a blouse factory, the illumination varies from about 10 to 19 foot-candles?—Yes; and the people are enthusiastic about the result of this light.

How is it that in another factory it has been sufficient to give 2, 3, 4, and 6 foot-candles?—In this case we merely supplied the lamps and compressors. Often we only supply the plant. But with few exceptions the workers here all expressed complete satisfaction.

May we say that for sewing light-coloured fabric illuminations of the order of 5 or 6 foot-candles are found to be very satisfactory?—Very satisfactory indeed.

Illuminations of the order of 3 or 4 foot-candles?—For light-coloured work, I should say so.

And for dark-coloured fabric?—I express the opinion that it ought to be at least three times as much.

It ought to go up to 10 or 12 foot-candles?—Yes, for dark material.

Replying to further questions, Mr. Whyte said that, as a matter of fact, while the firm had not been in the habit of arranging their light on the plan of foot-candles, this was beginning to be asked for. It was a sign of the times, and a very desirable sign. He had come across any number of factories in the London area where flat-flame burners were employed—chiefly for local lighting.

The Chairman: For local lighting in engineering shops, because there is nothing very much else to use near the lathes?

Mr. *Whyte:* I know that is fairly common; but we have been able to do away with it largely by using a high-pressure incandescent light properly placed. We also employ for this class of lighting an adjustable lever pendant, which allows of the light being moved to almost any position required by the operator over the working parts of the lathe.

Have you any evidence as to increased output or better work or more satisfactory or less satisfactory results accruing from your work?—Yes, particularly with regard to colour matching, and also the effect it has on temperatures. We had a letter this morning which says: "We consider the system conduces more to the health of the workers. After nearly eighteen months' experience of your high-pressure gas system, we should like to say that we have found it entirely satisfactory for our needs. The light has been continuously steady and brilliant, and is a great improvement on our former arrangements. Though our workrooms and offices are so much better lit than before, we have, at the same time, made a saving in gas consumption of over 50 per cent." I brought the letter to your notice because of the remark, "We consider the system conduces more to the health of the workers."

Witnesses, referring to sewing factories for blouses, &c., stated their opinions that the comfort of a machine operator was largely influenced by the amount of contrast that was rendered in the lighting—that was to say, in their judgment a general illumination of a fairly low intensity was preferable to an illumination which was greater at its maximum point, but which was cut up or interspersed with deep shadows. These shadows, they mentioned, were greatly exaggerated when dark material was being worked upon, since there was no reflection to equalize the distribution. They considered a much higher average of illumination should be maintained when work was being done on dark materials than was necessary with white or light coloured fabrics. What really mattered in this class of lighting was correct position and number of lights, which arrangement would provide for the elimination of shadows. In their opinion, with this class of work, the foot-candles where light work was dealt with should not be less than 3 to 4, and for dark work double or three times this.

Dr. *T. W. Heywood*, Certifying Surgeon for Darwen, expressed the opinion that until five years ago the lighting of the mills was undoubtedly bad. It was, however, an established fact that the rate of deterioration of eyesight was very considerably less than was the case some years ago; and this was in consequence of improved lighting. In his experience, accidents due to bad light had occurred.

Mr. Whetham: Do you think that bad lighting affects the nerves, or anything of that kind? For instance, do you think if one tries to read constantly by an insufficient light, it would definitely affect one's nervous system?

Witness: It probably would produce trouble with the nerves.

You have no actual evidence of specific cases of the workers?—None whatever.

The Chairman: Is incandescent gas more general in your neighbourhood than electric light?

Witness: Yes, they get a much better light. Another thing, incandescent gas is warmer; and that has something to do with these people.

Mr. *W. E. Potts*, appearing on behalf of the Royal Institute of British Architects, gave evidence with regard to the building of mills from the point of view of natural lighting.

Mr. *J. B. Gass*, F.R.I.B.A., said it might be taken that millowners generally appreciated the importance of proper lighting. Describing the artificial lighting of a mule room in a mill, he pointed out that gas was found to be the most satisfactory lighting, with the ordinary pressure, and the inverted mantles enclosed in globes. These were nominally 80-candle power, and were placed to illuminate 30 cubic feet and 2·5 square feet of area per candle power. The mantles had not too great an intrinsic brightness; they were kept as much out of the field of vision as possible; the light got well distributed; and they gave illumination with steadiness and economy. They were about six times as efficient as an ordinary gas-flame with the same consumption; and, with the globes, were free from danger, with reasonable care. Allowance was made in the arrangements for the drop in efficiency, which was from 30 to 50 per cent. in 100 hours; and they required changing after 250 hours' use. This supposed that 1-candle power would illuminate 4 to 5 feet. The figure of 2·5 feet was taken to allow for the drop in efficiency. In some mills electric lighting had been adopted throughout, using first the carbon lamp, and later the metallic filament. Ease of use, freedom from fire risk, cleanliness, and non-pollution of the air, gave electric lighting a special advantage; the main objection being the intensity of the luminous source. Incandescent electric lamps had at least twelve times as much intrinsic brightness as incandescent gas-lamps, and they did not give such equal diffusion of the light. There was the usual drop in efficiency with use. High-pressure incandescent gas lighting had the same disadvantages as electricity—too great intensity at the luminous source. Reflected electric lighting for mule spinning had been suggested; but as there was a heavy loss in the value of the actual illumination, it was unlikely to come into use, though it might be made very effective. There was at least 40 per cent. loss to start with. It was a very nice light; but this made it much too expensive. For weaving sheds and other processes where the light required concentration and local illumination was necessary, electricity could be satisfactorily used, as the direct light could be kept out of the field of vision.

The Chairman: Now we come to the question with regard to the possibility of fixing a standard, and the form of that standard?

Witness: Without making a standard, it might be desirable for the factory inspector, in conjunction with the local authority's engineer or surveyor, to have power to deal with cases in which the lighting, both natural and artificial, was such as to be injurious to the workers, with right of appeal by the owner in case of alterations being required or the building being closed, to a special committee of the local justices, who should be appointed for their special knowledge of, or connection with, the trades of the district.

Sir Arthur Whitelegge: You would base the matter, then, on the probable injury to the workers in health. You would include the sight in that, no doubt?

Witness: Certainly.

Would you agree to a suggestion made by the Chairman, that, without making a standard, it would be useful evidence in such a case to say the actual illumination in the room under discussion was very much less or very much more than, or equal to, that found in admittedly well-lighted sheds of the kind?—That would be useful evidence.

Mr. Parsons: Are there any injuries or any complaints of injuries to sight or health which have come to your notice?

Witness: No, they have not been brought to our notice.

Mr. Gaster: On the question of injury, do you take into account a man having to work under conditions where the light was badly placed, causing him to twist his body?

Witness: That would be an injurious condition, and would be one of the things which, if a man would not alter, any right-minded local justice would at once say had to be altered.

Several working tailors next gave evidence of unsatisfactory lighting and other conditions in workrooms, by which their eyes were affected. The light was gas; but it was complained that there was not enough of it. One of the witnesses, however, summed up the situation with the remark: "So long as you have workshops in the East end of London in private houses, the best of light will not help much."

Mr. *John Dewrance*, Chairman of the Parliamentary Committee of the Engineering Employers' Federation, asked what he would say as to some general kind of regulation that in factories under the Home Office the lighting should be adequate, replied that it seemed to him this was the best definition, or "as near as can be reasonably expected under the circumstances," because there must always be exceptions to any rule that was laid down. A large number of employers would be extremely grateful for any suggestions for improving lighting; but this might not be the case with people who were tenants only, and those who were not able to afford expensive alterations. There was no lighting which was always satisfactory, and which satisfied everybody. For most of his own workshops he had electric light for general illumination; but each particular machine had flat-flame gas-burners for individual lighting. He preferred electricity, but could not use it for individual lighting, because the lamps were apt to be broken. The men were always complaining about the light. Most complaints arose when there was daylight and artificial lighting. They had altered the artificial lighting in one factory, he believed, five times during his recollection, to try to get it as satisfactory as possible. They had incandescent gas. Then they went in for arc electric lighting; and afterwards they had two different systems of incandescent lighting. But the difficulty of lighting satisfactorily was so great that he did not pretend they had really solved it at the present time. It was exceedingly desirable that the lighting in all factories should be as evenly distributed as possible, rather than have big, powerful lights. The only experience he had had of any injury which he attributed to light was in the case of a man who had to watch the pouring of brass. It was extraordinary, but apparently the men who worked in badly-lighted places did not really seem to suffer.

Mr. *Lewis Solomon*, F.R.I.B.A., expressed the opinion that it would be very difficult to get evidence of direct injury from working continually in artificial light. High-pressure gas was cheaper and more effective than the electric light; and a man could work by it better. There was something about high-pressure gas which was not so deleterious as electric light to the sight. The workpeople liked it. He thought that at first there would be enormous difficulties in enforcing a standard.

Mr. *Segar Owen*, F.R.I.B.A., stated that of late years all the shops which he had built had been lighted with the ordinary arc lamp, and special provision had been made for reflecting the light on to the roof, and thus screen the immediate rays of the lamp from the employee's eyes. With the use of the metallic filament lamp, it had become of late more usual to light the shop throughout with pendant lamps fitted with this class of electric bulb. In this case, the opal shades of glass were sometimes reversed; but unless the roof members and boarding were painted of a white reflecting colour, a considerable amount of light was lost to the shop.

Mr. *Henry Hartley*, representing the Surveyors' Institution, stated that, in his opinion, the best form of artificial lighting was electricity, using the metallic filament lamps with prismatic reflectors. Next he placed high-pressure incandescent gas; and after that electric arc lamps. He regarded the first method, adopting metallic filament lamps of (say) 50 to 100 candle power as the best, for various reasons. There was a better distribution over the whole area to be lighted, a steadier light, and an absence of shadows, as compared with arc lights. The lights should be kept up close to the ceiling or to the underside of the tie-beams, so as to get a better diffused light. They should be fitted with reflectors of the "extensive" type, which distributed the light over a large area. The power and number of the lamps must be determined by the nature of the walls and ceilings. The distribution of the lights must also be determined by the same conditions. High-pressure incandescent gas lights should be placed as suggested for the metallic filament lamps, and should also be fitted with reflectors. The objection to this system in some cases was the heat that was generated. The unsteadiness of arc lights was a great objection to them. He did not think there would be any difficulty about a regulation to the effect that artificial lighting should be adequate.

Mr. *F. Skull*, of the High Wycombe Chamber of Commerce, gave evidence to the effect that it was scarcely possible to define or establish a standard or standards of adequate illumination suitable for the various operations and processes in the chair trade, neither was it desirable. Legislation requiring adequate lighting would not touch those he represented, because they already had adequate lighting.

Mr. *William Eccles*, another member of the High Wycombe Chamber of Commerce, and manager of a paper mill, said he scarcely saw how a standard could be defined, though he agreed that they must have adequate lighting.

Mr. *T. H. Thorpe*, F.R.I.B.A., appearing on behalf of the Derby Chamber of Commerce, stated that the manufacturers he represented wished him to say that they thought it was practically impossible to define and establish a standard of adequate illumination applicable to them. Some such regulation as was in force in Holland, he admitted, might be made. All manufacturers he had come across agreed that it paid to give good lighting. The general system in Derby was electric light. In a few cases he found that factories used high-pressure gas. It was preferred, he thought. He knew nothing of complaints as to lighting injuring the vision. His own personal opinion was that indirect lighting was better than any other.

The examination of this witness brought to a close the sittings of the Committee for the hearing of evidence.

CHELTENHAM GAS STRIKE ARBITRATION.

Mr. Mackenzie, K.C., an Arbitrator of the Board of Trade, presided at a conference at the Town Hall, Cheltenham, last Tuesday, between representatives of the Gas Workers' Union and the Gas Company, with reference to the recent strike. As reported in our issue of the 26th ult. [p. 214], the contest was ended by a truce, in which both parties agreed to submit to arbitration by the Board of Trade the questions of a war bonus of 3s. 6d. a week all round and of recognition of the Union. The Press was excluded by the Arbitrator from attending the conference, which lasted about three hours.

The men's representatives, interviewed afterwards, stated that the question of recognition of the Union was deferred for the present, and that the Arbitrator would only submit to Sir George Askwith his proposals in regard to the war bonus. The Arbitrator will, in due course, communicate his award.

QUALITY OF DUBLIN GAS.

Discussion at the Kingstown Council.

At this month's meeting of the Kingstown Urban District Council, Mr. J. J. Kennedy called attention to what he described as the bad quality of the light which the township was receiving from the Alliance and Dublin Consumers' Gas Company. It really was, he said, exceptionally bad. In the past, they had had reason to complain of the quality of the gas; but never in his experience had the light been so wretchedly bad as it was at the present time. There had been a new contract entered into at an advanced price, owing to the greater cost of production; and one would imagine that, when the Company were previously met by the Council with an increase—a substantial increase—on the previous payment, the quality of their supply would at least be maintained at that middling description of gas which they had been in the habit of getting. Now, however, the gas was wretchedly bad. Again, there were many cases where lamps were not lighted until it was almost time to turn them out. This was not fair treatment of the ratepayers of Kingstown. In a district not a hundred miles away, not very long ago, every second lamp was out at a time when all should have been lighted. Surely, if the Gas Company had not enough men employees to do their business, they could get women lamplighters. He suggested that the Company should be communicated with on the matter. It would be better to save the ratepayers' money and live in darkness than pay a substantial amount of public money for something which they were not getting.

The Chairman (Mr. M. F. O'Brien, J.P.) said he quite approved of Mr. Kennedy's action in bringing the matter forward.

Mr. Evans, J.P., said a great number of the ratepayers had been complaining of the gas—not only in regard to public lighting, but also as to private lighting. He did not know what the technical reason was; but the quality of the gas was getting worse and worse.

The Town Clerk was instructed to communicate with the Company on the subject.

MANSFIELD GAS UNDERTAKING.

Special Auditor's Report.

Following up the matters in connection with the Mansfield gas undertaking to which reference has been made in recent issues of the "Journal," the subjoined statement appeared in last Thursday's edition of the "Nottingham Daily Express."

Remarkable disclosures relative to the working of the Mansfield gas undertaking were revealed at a special meeting of the Town Council held last night at the Town Hall. The members met in private under the chairmanship of the Mayor (Alderman T. H. Maltby), to consider a report of the Gas Committee; and their deliberations in committee occupied a period of over two hours. It was after 10 o'clock when the Press were admitted to the meeting; and the Chairman of the Gas Committee (Mr. T. Smith) then made a statement on the matter.

At the outset, Mr. Smith remarked that the observations he was about to make would be made without bias; but he had a duty to perform to the ratepayers. The annual report of the Gas Committee presented to the Council, he said, was of such an unsatisfactory nature that the Committee had no alternative but to place the matter in the hands of a competent Auditor. They selected Mr. W. Gath, of Nottingham, who was given instructions to pay special attention to certain points, and to go thoroughly into the affairs at the gas-works.

In the printed report, the members would notice some big increases in the expenditure. These, of course, were largely accounted for by the extra cost of gas production—an increase which worked out roughly at £2550. On the income side, they had sold £1400 more of gas and residuals, and yet had realized £1200 less than last year. In spite of the loss allowed for owing to war conditions, the Committee found they had lost £1340 on the past year.

Dealing with the monthly reports and the actual facts of the yearly report, Mr. Smith said statements presented showed that the make of gas per ton of coal carbonized varied from 12,309 to 12,219 cubic feet, or an average of 12,157 cubic feet; but the yearly report showed the average of 10,971 cubic feet of gas made, or 1186 cubic feet less than the monthly report stated. This, on the year's working, misled the Committee to the extent of 21,944,558 cubic feet, or, in other words (taking the price of gas at 2s. 6d. per 1000 cubic feet), £2743.

Mr. Smith went into certain figures regarding bye-products, carbonization, and gas-stove hirings, and in conclusion said he thought the Council would be quite satisfied that the Committee had not been neglecting their duty, but that they had been misled by the reports presented monthly, over which they had no control. The Committee had anticipated a profit about as large as that of the previous year; and if they took the figures which he had given them, they would find they should have made a profit of £2003; whereas there was a loss of £1341.

The report, after a brief discussion, was adopted.

A Record Price for Dye.—A keg of about 1½ cwt. of methylene blue dye, which before the war would have been worth between £12 and £15, realized £310 at a Midland Railway lost property sale conducted at Derby last week. The bidding commenced at 5s.

Percentage Profits at Halifax.—Reporting on the accounts of the Halifax Corporation for the year ended March 31, the Borough Treasurer (Mr. G. H. Fry) states that the profit on the gas-works was £5758, or 0·88 per cent. on the total capital expenditure. The net cost at works for the manufacture of gas was 16·39d. per 1000 cubic feet, compared with 13·82d. the previous year. The electricity works profit was £13,036, equal to 4·29 per cent. on the capital expenditure. The water-works showed a loss of £11,195. Up to the present time, 342 of the Corporation staff have joined His Majesty's forces. The total amount of war expenses for the year was £6243, equal to a rate of 3·38d. in the pound.

SOUTHAMPTON GAS COMPANY.

The Half-Yearly Meeting of the Company was held last Wednesday,
nen there was adopted the report of the Directors, which stated that,
compared with the corresponding half of 1914, the sale of gas
owed an increase of 14,583,000 cubic feet. The revenue from the
le of residuals was also larger, arising from greater quantities being
oduced for sale, and also an improvement in prices. In order to
eet the great increase in the cost of coal and other materials used
the manufacture of gas, as well as the war bonuses paid to the
nployees and the allowances to dependants of employees serving in
s Majesty's forces on sea and land, which represented a very serious
dition to the ordinary charges the Company had to meet, the
rectors were reluctantly compelled to increase the price of gas by
. per 1000 cubic feet to ordinary consumers, and 2d. to prepayment
nsumers, as from April 1. This increase was very moderate com-
red with that made by many other gas companies. The amount
ailable for the dividend on the ordinary stock, after payment of de-
nture interest and other charges, was £13,966, to which was added
586, the undivided profit from the previous half year, giving a total
£19,552. The Directors recommended that the maximum dividend
5 per cent. per annum, amounting to £16,193 10s. for the half year,
paid (less income-tax), leaving £3359 to be carried forward.

Mr. J. C. Moberley, M.A., the Deputy-Chairman, who presided, read
ne notes prepared by the Chairman (Captain A. J. Corse Scott, J.P.),
o was absent through illness. These pointed out that the accounts
der review had only received the benefit of the increased price
ring the poorest quarter of the year. Coal had cost £8300 more;
average increase per ton being 8s. Savings had been effected in
er directions; but in order to pay the maximum dividends, it would
necessary to draw upon the undivided balance of £5586 to the ex-
t of £2227. Owing to the continued depreciation of securities, the
ectors had considered it advisable to write-down the values of the
estments from £54,203 to £46,156. During the summer, every
rt had been made to bring the stock of coal up to the normal; and
the present time the stock was the largest ever carried by the Com-
y. The number of employees who had joined the forces was now
rly a hundred; and doubtless under the new recruiting scheme
ny others would enlist. Protection had, in some measure, been
rded to the Company to retain a certain number of the employees
the issue of badges to those who were indispensable for the manu-
ure of gas and the directing of the Company's business. The
irman pointed out that in the matter of coal the Directors had been
atly assisted by the Secretary (Mr. J. R. H. Jacobs), who had taken
greatest trouble in the matter.

M. Howlett and Co. has been registered as a joint-stock company,
a capital of £20,000, in £1 shares. The business carried on by
firm is that of manufacturers of incandescent gas-fittings.

SOUTH AUSTRALIAN GAS COMPANY.

An Inquiry at Adelaide.

A number of sittings have been held, in Parliament House, Adelaide, by a Royal Commission appointed to inquire into the gas and electricity services in the city.

Addressing the Commission on behalf of the South Australian Gas Company, Mr. W. J. Isbister said the profits on the capital actually subscribed to the Company had averaged 14 per cent. This would have been the average return which an original shareholder, if he had lived and held the shares right on from 1861, would have obtained. He would not actually have received it; but this was what the Company had earned on the subscribed value. The money was not all distributed. The pioneers of such an enterprise were entitled to special consideration. The venture was not at all rushed at the start. Not all the share capital was taken up; and when the Company wanted to borrow money, they had to pay 8 per cent. for it; so that the figures which seemed so attractive were not quite the same proposition viewed in perspective. The net profits, not dividends, on the capital employed for the period 1910-13 were 11·36 per cent. This represented what might be called the high-water mark of the enterprise, when the Company had the advantage of all the reserve funds not bearing interest, and a great increase of business and prosperity which occurred in those years. The dividends all through on the capital employed amounted to 7·35 per cent. The dividend to the investor buying on the market was a little under 6 per cent. This was really the rate of return to practically all the present shareholders, apart from about 10 per cent., who had held shares for more than twenty years, and was the result of careful and prudent management, not distributing profits lavishly, and relying on the protection which it was assumed they had with regard to their rights. These figures were incontestable. Without making adequate provision for depreciation, but distributing all the profits, the Company would, even after a period of unexampled prosperity, have gone hopelessly smash. They could not possibly declare what their profit was until they had charged the revenue for the year with something for depreciation, among other things. The depreciation provision was not a part of the visible profits at all, and could not therefore have been added to the reserve fund. It was one of the working expenses, in the same way as wages. Some point had been made as to the amount carried to depreciation in one particular year; but what should be ascertained was the amount carried in the aggregate to this account. If depreciation had not been properly provided for in the past, a large sum had to be set aside for it when the want of adequate provision was realized. On the other hand, if proper provision had been made in the past, an average amount—it might be small—would be sufficient. If the sum set apart for depreciation during the last seven years was taken, the average worked out at £13,159; and the average percentage which this bore to the capital

THE MAIN GAS FIRES.

The ST. NICHOLAS.

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SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

employed was 2·69. If the facts were looked at fairly, as well as the figures, he did not think it could be said the shareholders had had an excessive return. The prices charged in Adelaide for gas compared very favourably with the rates in the other cities of Australia. The Company had from the earliest stage seen that, in order to induce business, they must reduce their charges at times. In Sydney, Melbourne, Brisbane, and Auckland, coal cost much less than in Adelaide. The longer hours of sunshine in Adelaide, compared with Melbourne and Sydney, and the need to cross a wide belt of park lands, affected the position from the standpoint of a lighting proposition. The Company had been subjected to a close and critical scrutiny—he did not say an unfriendly one—and it had tended to show that the business had been honestly and prudently managed. The return to the shareholders, who were in many instances persons of moderate means, had not been excessive, taking everything into account. The self-denial of the shareholders in not distributing all their profits had enabled the concern to be built-up with a stability which it would not otherwise have had, and allowed the Company to cope better with the progress made by Adelaide during the last ten years, thus giving the public a substantial share of the benefits which had accrued to the Company by reason of this progress.

PUBLIC LIGHTING OF MANCHESTER.

Fatalities through Restricted Conditions.

Animadversions respecting the public lighting of the main streets of Manchester were freely indulged in at the City Coroner's Court last week, when inquests were held respecting the deaths of persons knocked down by vehicles.

A fatality to a man named Gibson was inquired into on Monday. He had been fatally injured the previous Friday night by a motor-car in Albion Street, Gaythorn. The driver of the car told the Coroner that just at the particular spot where the fatality occurred two high-pressure lamps were fixed. Neither of these was lighted. Along the road, one lamp was lighted and the next was out, thus giving a light patch and then a dark patch. A passenger in the car said the public lighting of Manchester was exceptionally bad at the present time. Various protests had been made to the Gas Department about it. They had expressed the hope of being able to make things more comfortable; but some higher authority seemed to over-rule their proposed concessions. At the point where the fatality occurred, the lighting was very bad.

The fourth fatal accident in five days in which the lighting restrictions have been called into question was inquired into on Friday; a boy named Leonard Jones having been knocked down by a tramcar in the Bradford district, and receiving injuries from which he died. The driver of the car and other witnesses stated that the place where the accident occurred was particularly dark. The Coroner, addressing the Jury, said it appeared from the evidence that this accident was to some extent due to the darkness of the street. Something ought to be done; for it seemed to him that there would be more accidents of this kind if the bad lighting of the streets continued. It was necessary to take precautions under the Defence of the Realm Act; but he thought these could be carried to a somewhat ridiculous extent. Between 6 and 7 in the evening was the worst time for the public. Thousands of people were going home from work; and as much light was wanted in the streets as it was possible to get. He thought something might be done to provide better lighting between 4 and 8 or 9 p.m. The Jury recommended that representations be made to the civic authorities, to see whether this recommendation could be carried out.

WAR BONUS QUESTION AT OLDHAM.

Report of the Special Arbitration Committee.

A report on the conference between Sir George Askwith (Chief Industrial Commissioner) and representatives of the Oldham Corporation, the Gas-Workers' Union, and the Municipal Employers' Association, in regard to the question of granting a war bonus to employees in the Gas and Water Departments [*ante*, p. 94], was discussed by the Special Committee who have had the matter in hand, at a private meeting at the Oldham Town Hall last Thursday, when it was decided to recommend the Council to agree to the terms decided upon at the conference.

The claim of the men has been before the Council on various occasions during the last few months; the original demand of the men being for a war bonus of 5s. The Committee had recommended an advance of 2s. a week to all employees above 21 years of age receiving less than 28s. per week, and 1s. to those receiving 29s.—confining the bonus to those whose wages with the advance would not exceed 30s. per week. The employees' unions demanded an advance of 3s. a week all round, without any limitation to 30s. per week or any other figure. The Council refused this, and a strike had been threatened; but Sir George Askwith intervened, and requested a conference with the parties to the dispute.

The following are the terms of settlement:—

> The Corporation agree to give their employees of 21 years of age and over a war bonus on the following scale: Men receiving 31s. per week and under, 2s. per week. Men receiving 31s. to 31s. 6d., to receive 33s. per week. Men receiving above 31s. 6d., and up to and including 45s. per week, to receive a war bonus of 1s. 6d. per week.
>
> The above bonus is not to include men who have received advances since the beginning of the war, and is to date from Aug. 11 last. The bonus is not to be taken off after the end of the war without three months' notice being given, or a conference being held.

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COAL TAR AND ITS PRODUCTS.

Continuing the correspondence on this subject recently reproduced our pages [see *ante*, pp. 150, 211, 278] from the "Iron and Coal ades Review," the writer, "Distillation," on Friday last, made the lowing remarks.

The "little explanation" of Messrs. Hird, Chambers, and Hammond es not in any way alter my opinion that the article was misleading, d the statements exaggerated. In fact, their reply indicates that the ults they have put forward are mostly assumed or calculated, and t the result of practical operations.

n the article they said the results were realized from average tar; t in their reply we are given to understand that the tars were known be of high quality, and to contain high percentages of oil. The iter further gathers that the tars are from gas-works, which are erally of different quality from coke-oven tars.

Vith reference to the production of benzol, it was natural to assume en they spoke of rectification that they referred to finished and not de products; and certainly the prices given were those of finished ducts. As to the cost of production, they now state they are pre- ed to give a firm undertaking that this will not exceed £279 for ooo gallons. The writer knows, from several years' practical ex- ience, this cannot possibly be accomplished at the present day.

Vith regard to carbolic and cresylic acid, here again they reply by ring to send particulars of their patent plant. What the writer ed was: Where had a plant (described by them as a very simple nt) been erected by them and turning out the quantities they assert, l realizing the prices they quote?

Io satisfactory explanation is given why 1913 prices are used, instead present-day prices; and the only conclusion the writer can arrive is that the former are more favourable for the firm in pushing ward their particular plants. If anything approaching the profits ed could actually be realized, tar-distillation plants would be inging up wherever there were patent bye-product ovens and gas- ks. But it is known the large distillers are not realizing fortunes of tar.

Vhen the writer referred to the price of tar, he had in mind con- cts for average tar, and not a special product for which it may be sible 37s. per ton is obtainable. It stands to reason that with pitch which constitutes from 60 to 70 per cent. of the products of distilla- of average tar—realizing 15s. per ton at the works, and huge cks accumulating in the country, the distillation of tar is not making fabulous profits the firm would lead one to think.

hey ask, "When shipping conditions become normal again what the present stocks of pitch realize?" Business people, as a rule, not put money into a plant when the chief product is likely to be into stock, it may be for years, until they "wait and see" normal ditions reinstated after a world war has devastated countries and et all economic and financial conditions.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The death is announced of Mr. George Shearer, Town Chamberlain of Banff, who, in addition to various other offices, occupied the position of Secretary and Treasurer of the local Gas Company. He was 61 years of age, and was a native of Banff, in which town he had spent nearly all his life.

The abstract of the accounts of the Burgh of Forfar has now been issued in accordance with the provisions of the Town Councils (Scotland) Act, 1900. The figures in relation to the gas supply undertaking show that the outlay on gas manufacture during the year ended May 15 last was £7123—coal, including carriage, costing £5359. Distribution charges amounted to £549; rents, rates, taxes, and insurance, £534; the proportion of general administration charges, £135; and other expenditure, £1006. These amounts total to £9348. Sales of gas, after allowing discounts and adding arrears collected, brought in £7998; residuals, £2950; and other expenses, £680. There was a balance of £2281 to be carried to the net revenue account. From the statistics as to gas manufacture during the last financial year, it appears that 6307·4 tons of coal were carbonized, costing an average price per ton of 16s. 10d. The total make of gas was 62,780,100 cubic feet, of which 6,484,200 feet were unaccounted for, or a loss of 10·33 per cent. This showed the average quantity of gas made per ton of coal was 9954 cubic feet. The average price of gas during last year was 2s. 10d. per 1000 cubic feet. Since 1904-5, the amount of coal carbonized has increased from 3572 tons, and the make of gas from 35,058,700 cubic feet, to the figures already mentioned. The total revenue from the sale of gas and residual products advanced during the same time from £5990 to £10,879.

At the Granton Gas-Works, for Edinburgh and Leith, the blacksmiths have had their wages raised to 9d. per hour. In addition, the men receive ½d. per hour war bonus, and a number of other advantages—embracing three weeks' full pay and three weeks' half pay when sick, ten days holidays on full pay, continuous employment, and the benefit of a pension fund.

The Inverness gas stokers have obtained an increase of pay on a very liberal scale. The leading men are being paid 43s. 9d. per week, or an increase of 4s. 3d. per week; and the general stokers 40s. per week—an increase of 3s. 9d. per week.

The Perth Gas Committee have had an interview with a deputation of the employees of the department who have made an application for an increase of wages. The Committee decided to adhere to a resolution passed by the Council some time ago that no war bonuses or increases in wages be granted during the period of the war. It is understood that the gas workers have indicated their intention of approaching the Minister of Munitions in regard to the matter.

The Kirkcaldy Town Council have received an "ultimatum" from

The "Acmefont" Gas-Heated Boiler.

The "Acmefont" is specially suitable for warming Cubicle Buildings used for Sleeping Accommodation, Sick Bays, Changing Clothes, &c. The heating of each hut or building is under separate control, and this system of heating possesses advantages in
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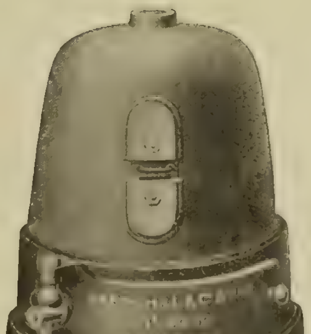

EXPERT OPINION FREELY GIVEN BY WELL-KNOWN HEATING SPECIALISTS.

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BIRMINGHAM.

the gas-workers. The men are demanding an increase in wages, and threaten to strike in a week's time unless a satisfactory reply is received. The Gas Committee have the matter in hand.

Last Saturday, a visit was paid by the Council of the National Registration of Plumbers to the Glasgow Corporation Gas Department workshops, in Walls Street. A very large party accompanied Mr. J. R. Sutherland (the Corporation Water Engineer), President of the Association. Owing to the absence of Mr. Ralph Halkett (the Commercial Superintendent) through illness, the visitors were received by Mr. James M'Ghee (Workshops Superintendent), who, in according them a welcome, referred to the great development which had taken place during the last few years in the Distribution Department. The party divided into three groups, who were accompanied through the works by Mr. M'Ghee and his assistants. The new card system introduced by Mr. Halkett was first of all explained, and thereafter the various shops were visited. The different types of machinery, the cooking and heating apparatus, and the repairing and testing of gas-meters proved of great interest.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Nov.* 8.

The tendency of the freight market seems to be a little easier, probably owing to the difficulty of fixing business at the high figures quoted. This may react somewhat on the price of pitch. Values of tar products generally remain the same as last recorded.

Considerable business is reported in sulphate of ammonia—£15 5s. per ton net, in buyers' bags, at makers' works, having been paid for 25 per cent. quality right down to June next; and the whole position is very firm.

Tar Products in the Provinces.

Nov. 8.

The market for tar products remains about the same. There is still very little business doing in pitch. Creosote is offering at reasonable prices. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 19s. 6d. to 23s. 6d. Pitch, East Coast, 18s. to 19s. per ton; Norfolk, Suffolk, and Humber ports, 18s. to 19s.; West Coast, 17s. to 18s. Manchester; 18s. to 19s. Liverpool; 20s. to 21s. Clyde. Benzol, 90 per cent., North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅞d. to 3d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Nov.* 6.

Throughout the week the market for this material has continued to advance steadily from day to day, and at the close the tendency is still upwards. There have been large requirements for practically all quarters, with the exception of Japan, and there has been keen competition for all available supplies. The nearest values for early delivery are now £15 12s. 6d. per ton f.o.b. Hull, £15 15s. f.o.b. Liverpool, and £15 17s. 6d. f.o.b. Leith. For future delivery higher figures have also been paid, and transactions have been reported at the principal ports at £15 17s. 6d. per ton for January-March, and £15 15s. January-June.

Nitrate of Soda.

There is no change in the spot value of this article, and holders are firm at 14s. 4½d. per cwt. for ordinary, and 15s. 4½d. for refined quality.

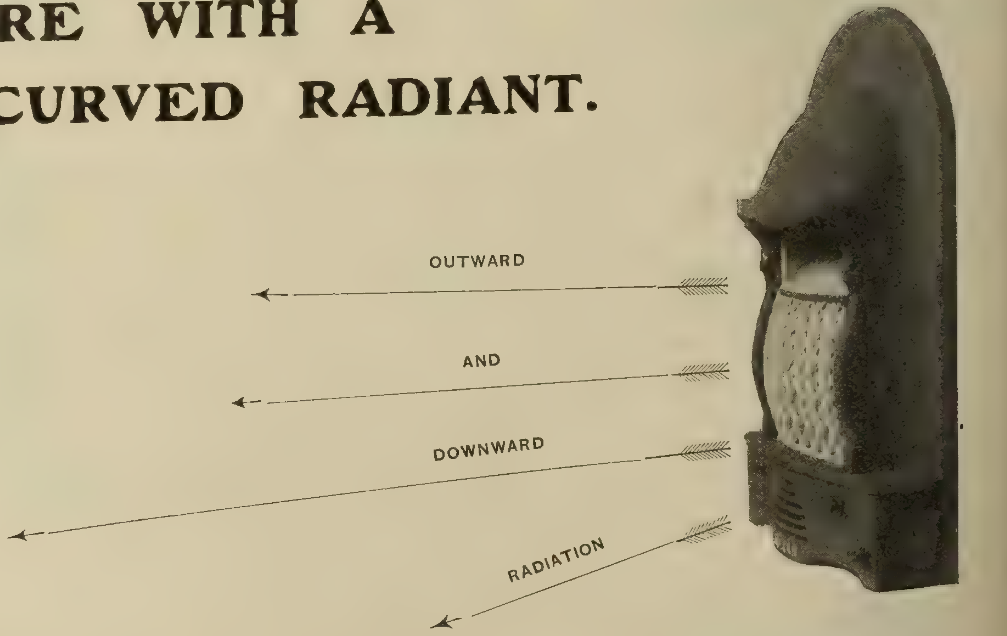
Sulphate of Ammonia.

From another source, it is stated that there has been considerable activity in the market for this article during the past week. Outside London, makes are quoted at £14 10s.; Hull, £15 5s. to £15 7s. 6d.; Liverpool, £15 7s. 6d. to £15 10s.; Leith, £15 10s. to £15 12s. 6d.; Middlesbrough, £15 7s. 6d. to £15 10s.

Meter Inspectors' Wages at Rochdale.—About a fortnight ago, a Special Sub-Committee of the Rochdale Gas Committee reported on the application of the meter inspectors for a revision of wages, and for ten days' holiday with pay in addition to the short Christmas, Easter, and Whitsuntide stoppages. Hitherto it had been the custom for the inspectors to book their overtime, and, instead of drawing pay for it in money, to have its equivalent in time off at slack periods. Accumulated arrears of this overtime had in some cases represented, if calculated on the money value of the time, a substantial sum. The Gas Committee, however, decided to abolish this custom, and to pay for overtime worked at the usual rate of about 8d. an hour. They also decided [in view of a previous resolution of the Town Council on the question of holidays with pay] that they were unable to grant the ten days' holiday with pay which the men asked for. At last week's meeting of the Gas Committee, a letter was read from the Gas-Workers' Union, on behalf of the meter inspectors, asking for fewer hours and holidays with pay; but the Committee decided that they could not go beyond their previous decision to pay for all overtime at extra rates.

An Obvious Advance.

A FIRE WITH A
CURVED RADIANT.



A Maximum of PURE RADIANT HEAT.

The "LANCET" says "This fire showed no escape of combustion products into the room whatever."
The "LANCET," June 12th, 1915.

MANUFACTURERS:
THE VULCAN STOVE CO., Ltd. EXETER.

COAL TRADE REPORT.

orthern Coal Trade.

The coal trade of the North is easier, chiefly owing to the scarcity f steamers; so that when these are available, prices slightly below hose current may be taken at times. Coal is well sold forward; but here tonnage does not duly arrive, collieries are hard put to for full orking. In the steam coal trade, best Northumbrians are from 19s. 6d. er ton f.o.b.; second-class steams are 17s. to 17s. 6d. per ton; and team smalls are 11s. to 13s. per ton—the latter class being rather lentiful. Production at the pits is fairly good, though it will be emembered that the export of coals to some of the northern countries ust now begin to show the usual decrease at this season. In the gas oal trade, the shipments are heavier, both for home and to the allied ountries. Best Durham gas coals are 19s. 6d. per ton f.o.b.; and for econd-class gas coals, 16s. 6d. to 17s. per ton is quoted. "Wear pecials" are steady at 20s. to 20s. 6d. per ton f.o.b. Deliveries of gas oals are good, except where steamers' arrivals are slow; but there is ow a general shipment of coals from the Tyne equal to that of a year go. The rates of freight are very firm—gas coal, Tyne to London, eing about 10s. 6d., with record charges to some of the Mediterranean orts. Even at the highest freights for many years vessels are scarce. oke is, however, being more freely shipped, and is very firm. Good as coke is from 27s. 6d. to 30s. per ton f.o.b. in the Tyne. From that iver the shipments of coke in the first nine months of this year are in xcess of those for the same period of last year.

◆

Sale of Gas Shares.—From £6 7s. 6d. to £6 2s. 6d. per share was ealized at a local auction sale last Thursday of 75 shares of £5 each, lly paid-up, in the Harwich Gas and Coke Company, upon which the aximum dividend of 7 per cent. has been regularly paid for the last n years.

Athy Lighting Problem.—It will be remembered that a few weeks go the Athy (co. Kildare) Urban District Council, disapproving of the as Company's action in raising the price of gas, owing to war conditons, decided that the public lamps in the town should remain unghted. At a special meeting last week, the Council resolved on proring oil-lamps for public lighting, "pending the introduction of ectric or other plant to compete with the Gas Company."

South Metropolitan Gas Company's War Bonus.—A notice was sued to the employees last month stating that the Directors had ecided to again follow the precedent set by His Majesty's Governent in the case of the railways, and to increase the war bonus to . weekly for all men above the age of eighteen years, and to 2s. 6d. eekly for those below that age. This will be continued until six onths after the declaration of peace. During this period, no applicaons for increases beyond the present current rates of wages will be onsidered. The first payment of the revised bonus was in respect of e week ending Oct. 21.

Retford Gas and Water Undertakings.

The annual report of the Retford Corporation Gas-Works shows that there now remains only £16,431 13s. 6d. unpaid of the £28,000 loan. There was expended during last year upon capital account £517 on new buildings, mains, and services. The total capital expended on the undertaking is now £56,733, and an over-expenditure of £234. There is a credit balance of £8139; and it is recommended that the sum of £2500 be transferred from the credit balance of the profit and loss account, which now stands at £8139. The revenue account shows that the amount received from the sale of gas and stove-rents was £9634, compared with £9546 the previous year—an increase of £89. Residuals have realized £3566, as compared with £4047—a decrease of £480, owing to the lower market price. The gross profits for the year are £2262, compared with £2422 the previous year. The reduced profit is more than accounted for by the increased price of coal, which amounted to £890 over the previous year. The sum of £500 has been paid out of the profits to the relief of the general district rate. The annual report of the water undertaking shows the principal repaid on account of loans during the year was £328. The whole of the loans raised have now been repaid; and the water undertaking is free from all debts and liabilities. There has been expended during the year on capital account the sum of £2627; the chief item of expenditure being £2495 for the purchase of 21 acres of land, and the balance on the extension of the mains to Welham. There is now over-expended on this account the sum of £2378; and it is proposed to transfer from the net revenue account a sum of £2300 to practically cover this over-expenditure. The revenue account shows an income for the year from water-rates and other charges of £3140, as compared with £3265 for the previous year—a decrease of £125. The working expenses and charges against revenue amount to £1841, as compared with £1926; and after paying the usual instalments and interest on the loans, there is a net profit of £793. Both reports are regarded as highly satisfactory, and as reflecting great credit on the Engineer and Manager (Mr. J. B. Fenwick).

◆

Newmarket Public Lighting Charge.—The Newmarket Urban District Council are still dissatisfied with the proposals of the Gas Company, in the matter of a rebate for gas unconsumed in the public lamps. At their last meeting, they considered a letter from Mr. J. H. Troughton, the Manager to the Company, stating that his Directors, though they considered their previous offer to allow £100 a fair one, would agree to grant a rebate of £150 on last year's lighting contract, in respect of gas unconsumed. This would mean dividing the loss equally. They also submitted that under their sliding-scale four-fifths of any loss the Company incurred would fall on the consumers, who were to a large extent the poorer ratepayers; and it would be more equitable for any loss to be borne by the ratepayers as a whole. Mr. Potts moved that the Council adhere to the first offer made by them, to accept a rebate of £200; and this was carried unanimously.

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Wet or Dry.

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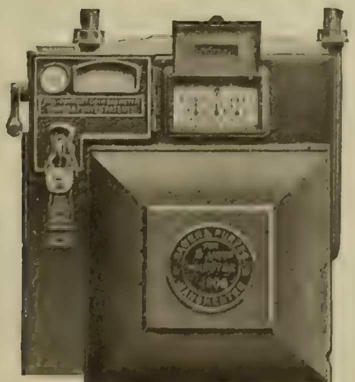

Any Coin.

FOREMOST IN 1915.

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RADFORD ROAD,
NOTTINGHAM

Oldbury Gas-Works and Enlistment.

At a meeting of the Oldbury District Council on Friday, the Gas Committee asked to be granted freedom of action in dealing with applications for allowances from men enlisting. Mr. Jackson (the Chairman of the Gas Committee) said if they granted the same allowances to their employees as the other Committees, it would cost them £600 a year beyond what they were now paying; and he was afraid they would have to further advance the price of gas, unless they were allowed freedom of action in the matter. Mr. G. Robbins said he would rather the price of gas go up than the Gas Committee should exploit their employees by refusing to give them any war allowances upon enlistment. Mr. H. Robbins remarked that by such action as was proposed they would, he was afraid, check enlistment. Mr. Green said if they had to make up the wages of men who enlisted from the works, sometimes the Gas Committee would have to pay 1s. or 1s. 6d., and in other cases as much as 17s. or 18s. a week. Ultimately the report was adopted; the Gas Committee being given freedom of action in regard to men enlisting. The Chairman said each case would be dealt with on its merits, and necessary allowances made.

Inefficient Lamplighters and Increased Mantle Consumption.—At the monthly meeting of the Horwich District Council, on the street lighting question being discussed, the Surveyor reported that he was experiencing considerable difficulty in getting suitable men for lamp lighting. Men took on the work, and gave up after one night. The mantle consumption had been very heavy, owing to the inefficiency of the lamplighters and carelessness in lighting. It was decided to continue the lighting of 287 of the lamps, or less than one-half.

Purchase of the Radcliffe and Pilkington Gas Company Advocated.—In the printed minutes of the Radcliffe (Lancs.) District Council there recently appeared a paragraph stating that the Finance Committee had decided not to send representatives to a conference to discuss the price of gas in Radcliffe, Whitefield, and Prestwich, on the ground that no useful purpose would be served by raising the subject at the present time. Mr. Chatterton recommended the three authorities to consider the question of purchasing the Radcliffe and Pilkington Gas Company's undertaking.

Toluol Treatment at Higginshaw (Oldham).—Mr. Arthur Andrew, the General Manager of the Oldham Corporation Gas Department, announced at the last meeting of the Committee that a letter had been received from the Ministry of Munitions expressing satisfaction that the treated tar of the Higginshaw works contained a very valuable percentage of toluol; and it was assumed that the toluol from the whole make of tar at the various Oldham Corporation Gas-Works would be in proportion. Alderman H. Wilde (the Chairman of the Gas Committee) said it was very satisfactory indeed to receive such a letter.

Fatality at Nelson.—A man named Edgar, employed as a labourer at the Nelson Corporation Gas-Works, was missed on Friday afternoon, and on a search being made his shovel was found near one of the coke-hoppers. Subsequently the body was discovered in the hopper completely engulfed in the coke. It was part of his duties to attend to the carts as they came in, and shovel the coke into an elevator, which carried it to the hopper, from which the carts are filled. The hopper contained small coke; and it is assumed that for some reason or other deceased climbed on to the top of the coke, and that it gave way beneath his weight.

Southport Coal and Coke Prices.—In connection with the Board of Trade's circular respecting the limitation of profits in the sale of household coal, the Southport Gas Committee have appointed a Sub-Committee to deal with the matter. In regard to this recommendation, the Southport Trades and Labour Council, at their meeting last Thursday, referred to the "inconsistency" of the Committee in such action, when "at the same time they themselves were deciding to put up the price of coke." Mr. Howson said the price had gone up because of the big demand, while Mr. Southworth remarked that he honestly belived the Committee could sell coke to the poorer people of Southport at 4d. per cwt. He considered 10d. per cwt. an absolute disgrace. It was decided to send a protest to the Gas Committee.

Proposed Labour Board at Birmingham.—The General Purposes Committee of the Birmingham City Council recommend the appointment of a Labour Board to deal with Corporation labour questions as they arise. Last July, the Council directed the Committee to consider the desirability of setting up such a body, to be given authority to determine the question of wages of workmen employed, conditions of their employment, and their transference from one department to another. The suggested Board will take the place of the Joint Committee on Labour which was formed a few years ago; and while it will act as a court of appeal in disputes between the Corporation Committees and their employees, it will not take away from the Committees the right of settling with their employees the rates of wages to be paid.

Gas Workers and War Badges.—In the course of a special meeting of the Stafford Town Council, held to consider the circular-letter addressed to local authorities by the President of the Local Government Board with regard to the establishment of local tribunals in connection with recruiting, a letter was read from Mr. T. H. Tunnicliffe, a member of the Executive of the Trades Council, concerning the wearing of war service badges by clerks and others of the Gas and Electricity Departments. The writer stated that it was ridiculous to say these men were on munitions simply because the works were producing a small quantity of chemicals. The Corporation ought to set an example to other employers by encouraging those of their staff who were fit to enlist. Alderman Westhead (the Chairman of the Committee) said it was not only a question of the chemicals being extracted for the Government, but the production of gas for the manufacture of munitions. The Chief Clerk was the only person in the office wearing a war badge; and undoubtedly his services were indispensable. Some 80 per cent. of the staff had actually joined the Army, including 60 per cent. of the fitters. The Mayor remarked that no doubt a good many were wearing badges who ought not to. He suggested that, in view of the altered circumstances, it should be considered whether it was desirable that all the men should retain badges.

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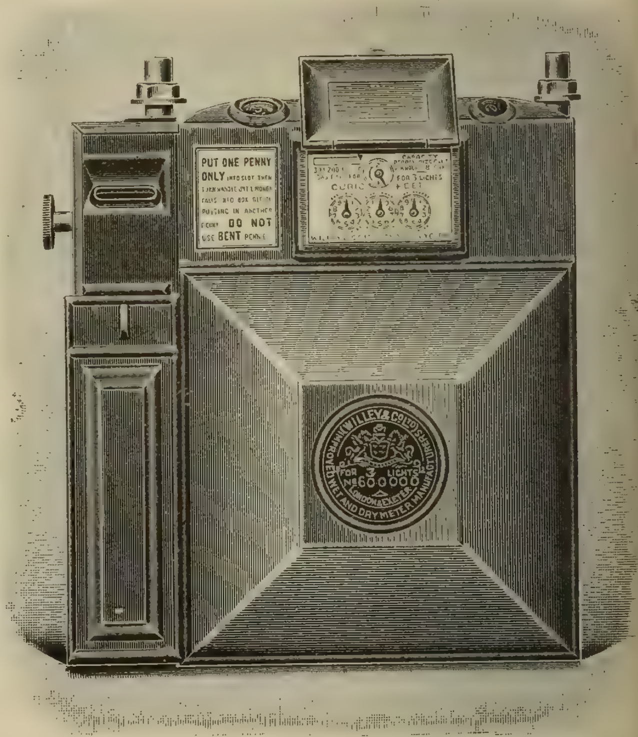

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GAS COMPANIES IN THE STOCK EXCHANGE.

Again the weekly chronicle of Capel Court is a bright one. The
ock Exchange re-opened on Tuesday—after its annual close-day
Nov. 1—overflowing with accumulated animation, and a deter-
ination to look at things with a cheerful eye. The favourable factor
recent weeks continued in full force. The great revival in the
'estern Hemisphere, with a wealth of harvest in Canada, prosperity
the States, gathering strength in Argentina and Peru, and other
ints more or less notorious now, exercised a potent influence over
e markets of the world. It is to be hoped that the upper pressure
ll not be overdone. Already, indeed, considerable profit-snatching
Americans and Canadian Pacifics has administered a warning. But
welcome recovery was apparent in our Home Rails after their per-
tent depression, and buyers would have taken much more stock had
been forthcoming. In Government securities, the War Loan was
m, and Colonial issues improved before the close. Japanese and
azilian were strong. A Japanese loan to France was among the
ssibilities discussed. The South African Market showed firmness,
d several members of the Miscellaneous group advanced—among
ich were rubbers and oils, and especially shipping. Returns from
otor companies and other undertakings engaged in the output of war-
e plant continue to show big war profits. Thus prices during the
ek have risen appreciably, save as stated above in regard to realiza-
ns; and there is little doubt that they would have gone higher if
ere were more of public confidence in our Home Government. The
w regulations as to marking bargains came into operation on Tuesday.
siness in the Gas Market was not able to maintain the degree of
tivity attained the previous week, and prices did not seem disposed
advance. The Monte Video Company will pay a 6s. interim divi-
nd on Dec. 1. In the Money Market, rates varied almost from
y to day. The rates fixed for new Treasury Bills created a good
mand.

Bargains done for cash during the week were as follows: On Tues-
y, British $35\frac{7}{8}$, Gas Light ordinary 76, 77, ditto debenture $62\frac{1}{2}$, Im-
rial Continental $63\frac{1}{2}$, Oriental 98, Primitiva preference $3\frac{3}{8}$, Totten-
m "B" $101\frac{1}{2}$, Wandsworth "B" 102, ditto Wimbledon 103, $103\frac{1}{2}$.
Wednesday, Continental Union $39\frac{3}{4}$, 40, Gas Light preference 73,
tto debenture $62\frac{1}{2}$, Imperial Continental $64\frac{3}{4}$, 65, Primitiva $2\frac{1}{16}$, $2\frac{1}{8}$,
tto preference $3\frac{7}{16}$, Southend 5 per cent. 90, $90\frac{1}{2}$, South Metropoli-
$76\frac{1}{2}$, 77. On Thursday, Gas Light ordinary $76\frac{3}{4}$, 77, $77\frac{1}{4}$, ditto
eference $73\frac{1}{2}$, ditto debenture $62\frac{1}{8}$, Imperial Continental $64\frac{3}{4}$, 65,
ttenham "B" 102. On Friday, Gas Light ordinary $77\frac{1}{2}$, ditto
aximum $59\frac{5}{8}$, $60\frac{1}{8}$, $60\frac{1}{4}$, ditto debenture 63, Imperial Continental $64\frac{1}{4}$,
$\frac{7}{8}$, 65, $65\frac{1}{4}$, South Metropolitan $76\frac{1}{2}$, 77. On Saturday, Gas Light
dinary $76\frac{1}{2}$, maximum $59\frac{7}{8}$, $60\frac{1}{4}$, Monte Video $9\frac{5}{8}$, $9\frac{3}{4}$, South Metro-
litan $75\frac{1}{2}$, 76, $76\frac{1}{2}$.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

* * *

As from the 1st inst., the address of the Coal and Coke Exports
mmittee will be Broadway House, Tothill Street, Westminster, S.W.

Through an electric cable fusing at the Grove Road Military Hos-
al, Richmond, one nurse received burns, and another was incapaci-
ed by shock.

Co-Partnership at Croydon.

The Co-Partnership Committee of the Croydon Gas Company, in the course of their report for the year ended March 31, state that the bonus is at an average rate of $5\frac{1}{2}$ per cent. for the year; the increase of 1d. in the price of gas from Oct. 1, 1914, involving a reduction of 1 per cent. in the rate of bonus. As a consequence of the further advance of 3d. in the price from April 1, owing to expenses caused to the Company through dear coal and other circumstances arising out of the war, the current bonus is at the rate of $2\frac{1}{4}$ per cent. The Committee feel sure co-partners will realize that this is inevitable for the present, and will be at one with Directors and officers in the hope that circumstances may soon admit of a return to a more satisfactory state of affairs, and in the resolve that all will do what they can to ensure that the Company may be able to reduce the price again as early as possible. Up to March 31 last, from the inception of the scheme, 887 co-partnership agreements have been entered into, and 241 have terminated; leaving 646 agreements in force. Of the 646 co-partners, 156 are now serving in H.M. forces; but the Directors have decided that the bonus shall be continued to be credited to the accounts as if they were still working for the Company. They are also relieved during their period of war service from payment of subscriptions to which they would be ordinarily liable to the superannuation funds or the workmen's sick and burial fund, though their membership of these, with the benefits accruing therefrom, is unaffected. During the year, £1879 was invested by co-partners through the scheme in stock of the Company, making a total to date of £10,582. The number of co-partners who are also stockholders is now 468. The Committee are glad to be able again to congratulate the co-partners on the facts that the savings (for the $6\frac{1}{4}$ years the scheme has been in operation) amount to 48 per cent. of the total credited as bonus, and that (apart from withdrawals arising from co-partners leaving the Company's service) only £4046 has been withdrawn out of a total of £12,601 available for this purpose.

* * *

Limerick Gas-Workers' Strike Settled.—The Limerick Gas-Works employees went out on strike recently; a demand by them for 3s. per week increase of wages having been refused. The following day, however, on the mediation of the Mayor, it was agreed there should be an increase of 2s. per week; and the men then returned to work.

Developments at Ashton-under-Lyne.—The Ashton-under-Lyne Gas Company are developing the Park Bridge district within their area. It is at present only a small place; but there are cotton-mills and iron-works in the immediate vicinity, and the prospective outlook is good. For the present, gas is to be supplied in bulk through a station-meter; and it is calculated that the Park Bridge consumption during the first year will be about $4\frac{1}{4}$ million cubic feet.

Clitheroe Gas-Works Profit.—In his annual statement relative to the finances of Clitheroe, the Borough Treasurer (Mr. J. H. Taylor) states that the gas-works, which was the only profit-producing department, earned a net profit of £649; the manufacture of the gas costing £8132, of which £6087 was spent in coal. The department paid, during the twelve months, a sum of £212 to the dependants of employees serving in the army. The total expenditure was £10,399. The maintenance of the water-works cost £1106; the income being £4543, of which £2756 was devoted to redeeming annuities, payment of interest on loans, and contributions to the sinking fund.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

pointments, &c., Vacant.

ssistant Engineer. Australian Gaslight Company. Applications by Nov. 20 to William Coward and Co., Limited, London.
ssistant Chemist (Oil Refinery). No. 6115.
ssistant (Montevideo Gas Company). Applications by Nov. 13.
istrict Inspector. Alliance and Dublin Consumers' Gas Company. Applications by Nov. 15.
ssistant Draughtsman. Birmingham Gas Department. Applications by Nov. 15.
oreman Fitter. Birmingham Gas Department. Applications by Nov. 15.
itter. No. 6116.

Plant, &c., Wanted.

Tank-Waggons. No. 6113.

Plant, &c., for Sale.

Producer Gas Plant. Royal Gunpowder and Small Arms Factories, Enfield Lock.
Typewriters. W. White, Northampton.

Company Meeting.

Oriental Gas Company. Finsbury House, E.C. Nov. 24, 12 o'clock.

TENDERS FOR

Coal.

Liverpool Gas Company. Tenders by Nov. 17.

Fire Clay Goods.

Bradford Corporation. Tenders by Nov. 18.

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'NEILL'S OXIDE
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GAS PURIFICATION & CHEMICAL CO., LD.,
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COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

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See Illustrated Advertisement, Aug. 24, p. 421.

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Copies of such Testimonials as may be considered necessary to be enclosed.

Applications, endorsed "Engineer," must be received by the 20th of November; the Appointment to be taken up in the early Spring.

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THE Directors of the Montevideo Gas Company, Limited, require the services of a Well-Trained and Qualified ASSISTANT to the General Manager in Montevideo.

Particulars as to the Terms of the Engagement can be obtained from the undersigned.

Applications, stating Age, Salary required, whether Married or Single, Qualifications, and Experience, both Technical and Commercial, with *copies* of not more than Two recent Testimonials, to be made not later than Nov. 13.

By order,
HENRY KEARNS,
Secretary.

Offices of the Company, 321, Dashwood House, New Broad Street,
E.C., Oct. 23, 1915.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

APPLICATIONS are invited for the Position of DISTRICT INSPECTOR to the above Company.

Candidates when applying must state previous Experience in Salesmanship of Cookers, Fires, Radiators, Water Heaters, &c., together with General Experience of Canvassing and District Work.

Applications, stating Age and Salary required, accompanied by *copies* of recent Testimonials, must reach this office on or before Monday, the 15th of November, 1915, endorsed "District Inspector," and addressed to

W. J. GREY,
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APPLICATIONS are invited for the post of ASSISTANT DRAUGHTSMAN at the Nechells Works. Candidates should have had some Experience in a Contractors' Office and must be well acquainted with the Design and Construction of Gas-Works Plant.

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Applications, addressed to the Engineer, Nechells Gas-Works, Birmingham, should be received not later than Monday, Nov. 15 next.

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LIVERPOOL GAS COMPANY.

TENDERS FOR CANNEL.

THE Directors of the Liverpool Gas Company are prepared to receive TENDERS for the Supply of 30,000 Tons of CANNEL, to be Delivered at the Linacre Works of the Company during the period of Twelve Months between the 1st of July, 1916, and the 30th of June, 1917.

Tenders will be received for the whole or any portion of the above quantity.

The Directors reserve the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

Full Particulars and printed Forms of Tender can be obtained on Application to the undersigned, at the Gas Office, Duke Street, Liverpool.

Sealed Tenders (on the printed form only), addressed to the Chairman of the Company, must be Delivered at or before 10 a.m. on Wednesday, the 17th of November, 1915, endorsed "Tender for Cannel."

R. E. GIBSON,
Engineer.

Gas Office, Duke Street,
Liverpool.

OURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING.
OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

OL. CXXXII., No. 2740.] TUESDAY, NOVEMBER 16, 1915. [67TH YEAR.

EDITORIAL NOTES.

State-Aided Research for Industry.

TURN can now be made to the consideration of the very
ctical criticism and advice (which appeared in our
orrespondence" columns last week) tendered by Professor
A. Bone, F.R.S., in respect of the Government scheme
the organization and development of scientific and in-
rial research. Such a scheme materialized has long
n overdue. While the Government have been devoting
h time, and expending lavishly on the details of our
estic life and affairs, they have simply bye-passed the
foundation—that of industry—upon the security of
ch our national prosperity relies. But this is not the
for reproach; it is the time to be thankful that the
ernment have seen the error of neglect, and to utilize
fact and their proffered aid to the best advantage by
ging to bear upon it good constructive effort. The
me now before us can only justify itself by result; and
ttain this there must be, precedent to the organization
development of research, proper organization of the
me itself—organization which will ensure its growth on
d and profitable lines. Any failure in this preliminary
only mean subsequent disaster in the production of a
of indifferent results; and there will still proceed the
waste of scientific and industrial brain power, arising
the want of system and co-ordination of work, and
rtunity for bringing scientific aid to bear upon the
ion of problems and the evolution of more efficient
t and methods.

ne danger of this, and other things, is foreseen by Pro-
r Bone, through the medium of a large personal ex-
nce; and so he has been examining the scheme in per-
tive, and has attempted to focus what, in his view, are
orrect fundamentals to adopt. Everything in the way
ccess depends upon the accuracy of determination at
eginning. Too much must not be attempted at first;
there must be shrewd discrimination as to the initial
es of investigation to be pursued. The first essential
entral fund for subsidizing a limited number of lines
vestigation. The second essential has equal import-
The scheme must not become, for men—however
ed—who have no knowledge of industrial affairs, a
n of refuge in which each can pursue his own bent in
rch without a definite objective, and without some com-
t guidance. Professor Bone's specification of the men
red is: "Scientific workers and technologists of repute
o are, or who have been, sufficiently in touch with
ctical affairs to have acquired at first hand a real
wledge of industrial affairs and of the economic factors
ch will necessarily come into play in connection with
new development." We are pleased to see that he
forefront place to this point; for the man factor is
ramount importance in the success of the scheme. To
assurance doubly sure, he counsels an advisory body
n from (say) the technical associations of the industries
ect the prosecution of the investigations selected.

e second practical point made is found in the considera-
governing the selection at the outset of particular lines
vestigation. These lines may be summed up by stat-
at they are those which show best promise of bringing
ustry and the nation, in the shortest space of time, the
material returns. The capturing of the successes that
earest within reach of systematized effort and explora-
will be nationally valuable and encouraging to both
ate and the workers. Professor Bone sees in the en-
ur to recover lost industries, to protect by scientific
pment those which may be threatened in the near
, and to produce betterment in the utilization of our
naterials (coal and bye-products), work which imme-
y lies at hand, and which will enhance the country's prosperity. Other considerations which should likewise be taken into account are the probability of there being a successful issue to the investigations within reasonable time; and the fact that the investigation involves expenditure beyond the financial resources either of the individual worker or of the institution in, or in connection with, which he may be working. There can only be endorsement of these suggestions, as well as of the three distinct classes of investigation which are put forward, and which, briefly stated, would seek: To establish new and more accurate scientific data or methods involved in the design of industrial appliances and plant, or in the daily scientific control and supervision of important manufacturing processes; to promote the greater efficiency of present plant and methods; and to convert scientific discovery into some really useful scientific invention.

So far, there is no difference with Professor Bone; only complete accord. In what follows, there may similarly be no substantial difference. But this depends on what is connoted by the repeated use by him of the term "scientific." If the word has, in its application here, limited definition, it requires expansion; if he intends a broad definition, there is little or nothing to cavil at in regard to it. In the latter event, it simply requires supplementing by another term. Before dealing with this point, however, let us say we have never been able to agree with the narrow-minded folk who think scientists working in our public institutions should not materially benefit from the fruits in invention of their talents, and their patience and perseverance in research. There is little use to oneself, beyond the honour, in being endowed with special gifts if their exercise is only to result in one being for ever tethered to a fixed reward and no encouragement or gain beyond. Therefore, it is only consonant with our past views in this matter to agree with Professor Bone that the individual "scientific" investigator, though he obtains assistance from the central national research fund, should be accorded the fullest credit and protection for the ideas he may disclose, and that his rights and interests in the commercial results of such invention should be equitably provided for and ensured. In other words, the "scientific" worker ought not to be in any worse position in regard to the development of his discoveries merely because he is financially assisted by the State than he would have been had he been financed privately; and unless this principle is conceded at the outset in connection with the Government scheme, it will never attract, or be invoked by, the "scientific" inventor for the development of his ideas.

There is concurrence with these points, which, as stated here, simply paraphrases Professor Bone's own more extended submissions. But it will be observed how consistently the writer prefixes to "investigator," "worker," and "inventor" the adjective "scientific." This is where it appears to us that a little amplification is desirable on the part of the Professor. The scheme would lamentably fall short in good effect and profit if only the ideas and discoveries of the "scientific" worker or inventor were allowed to come within its beneficial influence. The scheme is for the organization and development of scientific and *industrial* research. Fertility of idea, discovery, and invention is not the sole property of the scientific worker. Some of the very best ideas, discoveries, and inventions have come from men who are technically skilled, or are daily in contact with the practical working of processes, but cannot claim to be scientists, except perhaps in a very limited and special sense, and maybe not even to that extent. Their ideas, discoveries, and inventions may be crude; but, scientifically developed, they may prove of vast material gain industrially and therefore nationally. Those men, though not able to lay claim to being "scientific," must, in the matter of protection, if they have recourse to the valuable help of the State-aided scheme, be on an equality with the "scientific investigator," the "scientific worker," and the "scientific "inventor." If not, the very end that Professor Bone now chiefly desires will be quite frustrated—that is, to make the State-aided scheme a real serviceable factor in the development of home industries and of national prosperity, through increased economy and efficiency, and the opening-up of new processes and methods and the extension in good effect of old ones, with adequate reward and protection (even against piracy by foreign countries) for those with whom rests either the genesis or the development, or both, of new ideas. We do not think the limitation Professor Bone's frequent use of the word "scientific" conveys is intentional, unless it be with a desire specially to impress the cause of those who, through their position and environment, are less able to defend their own interests than the man who is associated with industry, and has easy access to private resources for assistance.

Working Experiences in Tar Dehydration.

The subject of tar dehydration, or first-stage distillation, has entered into prominence in the gas industry as a matter of practical politics; and it is a branching-off into a (for the industry) relatively new process which is going to be largely extended in practice. There are a good number of these plants already in existence on gas-works; and there would have been a larger number still had it been possible to promptly obtain them. The fact that there is the prospect of very considerable expansion is not only in view of the requirements for the war, but because the process is acknowledged to be an economic one, which not only holds profit, but supplies the convenience of being able to meet the Road Board specification in relation to treated tars for road spraying and construction. With the prohibition, ruling during the war, as to selling untreated tar, many gas undertakings without dehydration plant, and many road authorities who require tar for road purposes, have found themselves in an unpleasant position—the former bodies because they could not supply the tar; and the latter because, the local supply being closed to them, they have had to incur the expense of going farther afield for tar, or alternatively have had to go without. Through this, and probably in part through the Road Board first conserving their finances, and now having those finances diverted into another channel, the past year has seen the country slipping back into more dusty highways, with the nuisance and discomfort that are promoted under the stimulus of modern traffic. The case is good all round for tar dehydration where a works is large enough; and as to the tar itself, it is now more amenable to treatment at the place where it is produced with heavy-charge carbonization than it was in the days of high-temperature light-charge carbonization, when, using some coals, there was in the tar an excessive proportion of water and free carbon. The change in respect of lower water content means for dehydration to-day lower fuel expense, and greater working capacity of the plant. This is illustrated by the differences that are found in treating carburetted water-gas tar containing a large percentage of water, and coal-gas tar containing only one-third to one-sixth the amount—the higher the water content, naturally the slower must be the travel of the tar through the still.

Therefore, the principle that tar dehydration is a proper thing for gas undertakings has been widely accepted—particularly since the "C" process came into operation for providing more toluol for the war; and already those who are experienced are discussing details. But the pious wish may at once be expressed that authors of papers on the subject would adopt some common basis in presenting working experiences and results, so that ready comparison could be made. There were two papers on the process read at the meeting of the Southern District Association of Gas Engineers and Managers last Thursday—one by Mr. Frank Livesey, of Maidstone, where a Wilton continuous still is in operation, and the other by Mr. R. Wardell, of Tottenham, where the "Hird" continuous process is in use. The other day there was also a paper by Mr. E. V. Chambers, before the Manchester Institution on the same topic. The three papers illustrate the point as to disuniformity in the rendering of data. Mr. Livesey, who already had a long experience with his plant, presents his temperatures all in degrees Centigrade, Mr. Wardell his in Fahrenheit, and Mr. Chambers kindly gives both in some cases, and unkindly only in Centigrade in others. It is, of course, easy enough to convert from one to the other for comparison purposes; but it is troublesome and a waste of time when the author could perform the service for all his readers. It would, therefore, be advantageous if authors would speak in degrees Fahrenheit in all communications on this subject.

Then, again, in showing the financial results—working expenses and receipts—it would be better if there could be something like co-ordination in their rendering. Admittedly, working expenses will fluctuate according to the scale of operation, the methods of working, the character of the tar with which the process has to deal, and time. Costs, of course, must be given as found, consistent with plant and local circumstances; but it would be better if they did not refer to a temporary period of extremely abnormal conditions. In the papers mentioned, we have two of the authors adopting very widely different values. Mr. Livesey takes the war price for coke of 30s. per ton; Mr. Chambers for coke breeze, only calculated on 10s. per ton; and Mr. Wardell leaves his readers to compute for themselves the details of his various charges from the total figures that he presents. This does not facilitate comparison. However, the discussion on the two dehydration papers presented at the Southern meeting was adjourned, as the members ran off to the consideration of the "C" process, and the subject of dehydration was hardly touched upon. In view of this postponement of discussion, it would not be a bad thing—seeing that different plants are dealt with by the two authors—if, before the next meeting, they would try to co-ordinate their tabulated data on a better basis for comparison. Then, again, Mr. Livesey's figures are for coal tar and carburetted water-gas tar mixed, which water-gas tar contains from 25 to 40 per cent. of water, and so raises the average. Mr. Wardell's figures are for carburetted water-gas tar alone, containing about 31 per cent. of water. It is necessary, therefore, in this matter to get details well in mind, before attempting to contrast the working results; otherwise the superficial consideration of figures may lead one very much astray. It behoves those who treat of this subject for information purposes to put the essential details as prominently as possible.

Most processes the results of which depend upon temperature conditions in relation to the material to be treated which differs as does tar in composition, require very clos supervision, in order to attain the best results; and wit a dehydration plant every manager must, by experiment under his own local conditions, make determination in thi regard, guided, of course, by any pre-experience available If only Mr. Livesey's paper were read, his experience noted in connection with temperatures, and similar troubl were anticipated, it would probably deter many managers i a position to adopt a dehydration plant from doing so. M Livesey's plant, however, was installed in 1911; and ther has since been a good amount of independent work done t better adapt such plants to gas-works purposes, and to eas manipulation. But regarding temperatures, the papers mus not be taken as giving any definite information for guidanc under all circumstances. Heat economy is obtained in bot systems described by a heat-interchanger, which enable the ingoing crude tar before reaching the still to extrac heat from the outgoing tar. Mr. Livesey, in order to rais his ingoing tar to a proper temperature before admission t the still has introduced a steam-heater as an auxiliary t the interchanger; and, by this means, he is enabled to rais the temperature of the ingoing tar to 100° C. This is th "minimum" temperature advised by Mr. Chambers; bu we find Mr. Wardell working with his ingoing carburett water-gas tar at a temperature of 160° Fahr., although th water content is so high. Then Mr. Livesey finds that h working his still at 230° C., he can entirely denude th tar of all toluol. This is the temperature at which it necessary to work in order to comply with the Road Boa specification for tar-spraying purposes. But Mr. Chambe on the other hand, states that the temperature should not less than 260° C. (or 500° Fahr.) if the whole of the benz toluol, and phenol are to be removed; and Mr. Ward agrees with this, although admitting that with a still te perature of 400° Fahr., "all the light oils, and most of t "phenols are driven off." Mr. Livesey, however, prefe and does work at, a temperature of 220° C., as at the high temperature he finds that the tar becomes extremely thic There is thus some antagonism here between the Ro Board specification and the condition of the tar worki at the prescribed temperature of 230° C. Of course, Mr. Livesey says, the tar could be thinned out by creoso but this is now wanted by distillers for toluene extracti He fears that, if the tar is not removed and used in c weather with reasonable speed, it will be impossible to t out of the barrels or underground tanks. It is suggested, iowever, that, if the difficulty becomes acute, the creosote nay be redistilled into two fractions, and the heavier be re- urned to the tar.

The question of temperatures in relation to the composi- ion of the crude material and results is the chief one in this lehydration process, because there cannot be any standardi- ation of exact temperatures applicable to all circumstances. Iowever, the process is shown in the papers to be a profit- ble one; and it enables all gas undertakings to do locally vhat the road authorities require. There may be incidental ifficulties with regard to the disposal of certain products. new departure of this kind is, however, rarely without its ccompaniment of troubles; but, as a rule, their subsidence omes with time and development. As Mr. Livesey points ut, there are minimum limitations to the size of works that an adopt full tar distillation. This fact and the difficulty f disposing of certain products in the small quantities which ome works would produce, directs attention to the question f the foundation by groups of undertakings of central plants r rectification and fractionation of the light oils and deal- g with the dehydrated tar. This is a matter for the future. here is another point referring to the future. Mr. Livesey es not agree with those who say that, after the war, the mand for rectified products will be good and the prices gh. "My own experience," he says, "goes to show that, in normal times, the distillate produced is sometimes unsaleable, and seldom fetches a price greater than that of dehydrated tar." Mr. Livesey bases his opinion upon past ex- rience; but the normal times of the past may not repre- nt normal *post*-war times. If one of the issues of the war not a greater self-reliance of the country on home-made r products, then the country will be inflicting a gross justice upon itself. It is true that the production of tar likely to increase. So will the population; so too will the me demand, and so too, it is hoped, will British exports. e standards of requirement of the past must not, and will t, be the standards of the future. Even in respect of ex- osives, the war has set up a new standard for national otection. We are not, therefore, prepared to measure the ture by the past in this matter of tar products, and shall line to look forward hopefully, and not pessimistically, in gard to it. A word or two more. There is entire accord th the last lines of Mr. Livesey's paper; so much so that y may be emphasized by quotation: "While it is un- loubtedly the duty of every gas undertaking not to spare tself to assist the Government in every way, it is only ight that the Government Departments should make it heir business to see that no excessive profits are made. t the same time, the carrying-out of this patriotic work hould in every case be a source of a fair and reasonable rofit to the gas undertaking."

ias-Fire Efficiencies—Thermal, Hygienic, and Ventilating.

E low atmospheric temperatures of recent days have in turned particular attention to the practical applica- n of gas to domestic heating purposes; and users, through sonal comfort, extract considerable satisfaction from the t that progress in gas-fire design and efficiency has been uch excellent rate during the past few years—progress more to recourse to scientific aid and guidance than to thing else. The members of the London and Southern ior Association last Friday evening were, therefore, ap- priately occupied in listening to a lecture, which was structive in the matter of new ideas concerning gas- s and destructive in the matter of some old ones. fice it to say as a proof of interest that the lecturer was Harold Hartley, M.Sc., chief of the technical staff and oratories of the Richmond Gas Stove and Meter Company. ne two years or so ago Mr. Hartley delivered a lecture re the Yorkshire Junior Association; and the present puts us in possession of the development of views and rmation that has since taken place.

he lecture covered much ground—so much that it is only sible, apart from the publication of the full text in other mns, to touch here generally upon some of the topics posing it, and to extract from the remainder what are ceived to be the chief lessons of the new work to which ntion is directed. In the first place, criticisms were anced to be added to precedent ones with regard to the aratus used in the Leeds test for gas-fires; special refer- being made to the Rubens thermopile, which appears e totally unsuited for this work. Then, touching more general matters, the lecturer levelled hard blows at former conceptions and some present practices in relation to the gas-fire. In, for example, discussing the hygienic standard, Mr. Hartley pointed out that the tendency to adopt a large flue-outlet is to be deprecated, as it neutralizes the advantage of the high canopy in a fire, and involves excessive thermal loss. We do not desire to depreciate hygienic efficiency in order to gain in thermal efficiency; but we do not want to lose thermally, if means other than the large flue-outlet (aided by other structural considerations) will preserve to the user full hygienic efficiency. Something as to Mr. Hartley's views upon this matter is obtained when he draws attention to the "Lancet" suggestion that, in connection with the test standard for hygienic efficiency, a length of 2 feet of flue-pipe should be used—that is to say, the elbow and a little bit more. The lecturer appears, however, to strike the mean, in performing the hygienic test, between a fire *minus* elbow and flue-pipe (unaided by chimney draught) and the "Lancet" suggestion of 2 feet of outlet-pipe, by submitting that, rather than have a large flue-outlet, the hygienic standard of test should be a fire standing in the middle of a room, but aided by a flue elbow, without any piping whatever.

It is pretty clear from this and what follows that the time has come when the construction of a gas-fire should be considered as a whole, and not construction for hygienic purposes receive consideration separate from construction for giving maximum thermal efficiency—that is to say, the bearing of hygienic efficiency, thermal efficiency, and ventilating efficiency the one upon the other should be studied; and the structural embodiment should be such as to secure the maximum efficiency in each regard, without the attainment of one form of efficiency adversely affecting one of the other forms. This point is accentuated when Mr. Hartley says (and we read it with some surprise) that the over-all thermal efficiency of the best type of gas-fire is only 60 per cent., through there being, practically speaking, no convected heat available. The explanation is probably this, that hitherto in gas-fire testing the radiant heat has been directly determined, and so has flue heat, and the balance has been assumed to be convected heat available for room heating. The assumption as to the balance being convected heat is quite justified; but the assumption as to the destination of the heat must, of course, depend on the location of the fire. It would only all be available for room heating if the fire stood out from the wall of a room with a flue independent of the wall. But if the fire stands on the hearth at the foot of the chimney, some of the convected heat must pass up the chimney, and not out into the room. It is easy to agree with the lecturer that it is better to have some convected heat in the room than to send thermal energy unnecessarily up the chimney—of course, assuming, as mentioned in the lecture, that the thermal energy cannot be realized in the radiant form. High thermal efficiency is essential for the universal adoption of gas-fires.

Following the course of the lecture, the ventilation question in relation to gas-fires is gone into in some detail; and it is seen that the experimental results have been subjected to mathematical analysis. The results obtained show striking agreement with the theoretical deductions; and this is where a strong case is submitted for the adoption of small flue-outlets (subject to the satisfaction of the hygienic standard), with subsidiary openings for ventilation purposes. At the end of the section of the lecture dealing with this subject, the conclusions with regard to ventilation are summarized; and these will well repay study. Fig. 3, too, is of special interest, as it indicates the very marked manner in which the volume of air actually passing through the flue-outlet may be decreased by proper attention to the relative sizes of the flue-outlet and the subsidiary ventilation openings; and it must follow, *primâ facie*, that the mode of ventilation that is adopted will affect the amount of the thermal energy transmitted to the chimney. In other words, it is necessary to keep down the thermal loss through the flue-opening as much as possible compatible with other essential considerations. It is also maintained that at least 80 per cent. of the possible ventilation can be obtained by ensuring that the resistance of the inlet to the chimney is no greater than the actual resistance offered by the chimney itself. It would, of course, be impossible to reduce the resistance of the inlet to the chimney to zero; and there would seem to be little advantage in increasing the inlets beyond the point which enables the 80 per cent. efficiency, in this respect, to be attained. The concordance between the experimental results and the theoretical equations for the ventilation is strikingly shown in fig. 6, which, in our opinion, speaks well for the mode of experiment and for the deductions made.

Later in the lecture, the case for the more uniform distribution of the radiant energy emitted by a gas-fire is discussed, with special reference to the Richmond "R.H.D." fire. In connection with this fire, there was recently some controversy in our columns in which was raised the question as to the possibility of the escape of products of combustion through side draughts; and this point is analyzed. What Mr. Hartley says about the matter sums up what we consider to be the excellent case that the makers have at command upon this point. The broad survey made by the lecturer also includes considerations affecting the subject of the silent flame. It has been stated by some makers that the production of a silent flame depends upon the mixing of the gas and air. Experimental evidence in the lecture and the examination of the subject rather refutes this view, and suggests that the explanation is connected with the existence or non-existence of eddies in the gas stream. Even more important is the statement that the adoption of a high-temperature flame in a gas-fire does not increase the radiant efficiency of the fire. One is inclined to be carried away with the idea that local high temperature in a gas-fire radiant must involve increased radiant efficiency, as radiation from a hot body varies as the fourth power of the absolute temperature. A point that is frequently overlooked is that the adoption of a highly aërated flame does not necessarily involve an actual increase in the mean effective temperature of the whole of the radiant, nor does it ensure a decrease in the flue loss. The point is undoubtedly one of importance. In the concluding part of the lecture, an indication is given as to how a net gain of roughly 5 per cent. in radiant energy may be obtained with certain fires with proper attention to details.

These comments will give point to the general lessons to be extracted from the lecture, which, as already intimated, presents us with the results of work in continuation of that previously done and published. In carrying out this work, the Richmond Company have not only contributed to the advancement of their own interests, but to the general weal of the gas industry. Such work, we feel, ought to be recognized by those who are concerned with the manufacture of gas; for the experimental work involves the employment of skilled men and the expenditure of time and much else. In the case of this lecture, all the experiments, the results of which are embraced in it, were, it is clear, carried out, under Mr. Hartley's supervision, in the department of which he has charge. In saying this, we are sure that he would like us to draw attention to the acknowledgment at the end of the lecture of his sense of indebtedness to the loyal assistance of his staff.

Professional Salaries—The Inquiry Circular.

Some time since, protest was made by us, in the name of the gas profession, against the action of the Stoke-on-Trent Corporation Gas Committee in sending out an inquiry circular as to the rates of salary paid to the chief executive officials of other gas undertakings. There is a great difference between an inquiry of this kind, and one which has to do not with an individual—and he a professional man—but with a class of workers, such as stokers. The Directors of the Slough Gas Company are the latest offenders in canvassing for information as to the salaries paid to the engineers and managers of other gas undertakings; and protests against this have reached us from certain of those whose private business in this respect is the subject of their inquisitiveness. The Slough Directors would think it a piece of very bad taste and impertinence on the part of anyone who sought behind their backs exact particulars as to their own private incomes. What they would think of such inquirers, other people are to-day thinking of them. The object of the inquiry is in connection with an application for an increase of their own Manager's salary; and the Directors ought to be good judges of the justice of the application, without the aid of information from outside sources. The questions put are: (1) "Make of gas per annum; (2) salary of engineer and manager; (3) if any, and what, assistants; (4) if house, coal, gas, &c., free; (5) number of years' experience as manager." Regarding these questions, they indicate an idea that the recompense of a gas engineer and manager is something to be measured by very definite rule. It is nothing of the kind. The recompense of an engineer and manager should have relation to the value of his services to the undertaking. The question of the number of years of experience is not the chief consideration. Capacity is anything but a negligible quality; and capacity is not the exclusive property of those with years of service to their credit. We know of men of all years of experience in the profession—few years and many years—whose capacity is proved and undoubted. But capacity varies; and the capacity applied by an official to the affairs of a gas undertaking should be paid for. We do not say that capacity-*cum*-experience should be overlooked. However, let Gas Directors and Committeemen show their own capacity for administrative work by acting justly to their engineers and managers, and not treat them as though there exists a sort of settled market value for their ability and services as in the case of unskilled labour.

Coke-Oven Gas for Town Supply.

The development of the use of coke-oven gas for town supply in this country is proceeding slowly, but surely. Without mentioning small utilizations, Middlesbrough set the ball rolling; now Leeds has given the ball another effective push; and certain large Corporations last parliamentary session took power to enter into contracts for the purchase of such gas for supplementing their supplies. By what has been done at Leeds, past waste of good gas has been stopped at the coke-ovens of the Middleton Estate and Colliery Company, and has been brought into serviceable use, to the daily extent of 1 million cubic feet or thereabouts, in connection with the gas supply of the City of Leeds; and this has been proceeding now for about a month past with every satisfaction, as will be seen by the information courteously supplied to us, at our request, by Mr. W. B. Leech, the Engineer and Manager of the Corporation Gas Department. Thus waste has been converted into an economy; and while the Colliery Company are benefiting therefrom, it is quite certain that the Corporation Gas Department is also reaping advantage from a bargain with which an engineer and business man of such experience as Mr. Leech has had anything to do. The coke-oven supply is only equal to about one-fifteenth part of the maximum daily output of the Leeds Gas-Works; and this fact safeguards the city in the event of any temporary interruption of the supply. The gas is delivered to the Dewsbury Road works, through a steel main (details of which and the auxiliary plant are supplied in the article elsewhere in this issue), at a minimum pressure of 8 inches. The agreement as to supply contains protective conditions respecting quantity and quality; and concerning the latter, minimum candle power and calorific power and maximum nitrogen content have been specified. Payment for the gas is on a sliding-scale according to calorific power between 400 and 600 B.Th.U. This is another notable contribution to the forging of the chain linking together the gas-supply industry with the coke-oven industry.

Gas Appliances for Holland.

An esteemed correspondent in Holland sends a letter which is published in our "Correspondence" columns, and which gives a pressing invitation to British makers of gas-consuming appliances to cultivate the market offered by Holland for their wares. The efficiency of British makes is known in that country; and would-be users are waiting there with open arms for the manufacturers of this country to meet their requirements. The gas industry of Holland sees that the easiest road to the development of consumption lies through the best systems of gas utilization, not only in respect of domestic gas appliances but of industrial ones. Makers will be very hard-hearted, if they can resist the closing words of our correspondent's letter: "Make your British firms—all of them—understand that we wish to co-operate in every possible way in order to promote the beautiful system of heating with the modern British gas-fires."

Municipal Work in Birmingham.

The proceedings last week in Birmingham, in connection with the election of Lord Mayor, were of peculiar interest, from the fact that the choice fell on Alderman Neville Chamberlain—forty years after his father, Alderman Joseph Chamberlain, was elected for the third year in succession. Such an event invites reflection on the happenings in the interval; but there is little opportunity for that now. The present moment sees Birmingham changed from a hive of peaceful industry to one of the most important centres in the country for the production of munitions of war. The effects of this changed direction of ctivity—which has, it may be pointed out, been accompanied by e departure of no less than 100,000 men from the city to join e Colours—have been generally felt, and not least by the Gas epartment. The number of firms engaged on war work, and the ct that many of them are working day and night, has placed a avy tax on the resources of the undertaking. For the first half the current financial year, the output of gas showed an increase more than 13 per cent. on that of the corresponding period of 14; and the demand is still growing. This is a state of affairs ich, as was recently notified in our columns, calls for the im ediate provision of further carbonizing plant. In other direc ns much the same state of affairs exists; and the problems to faced are many. With the urgent requests for economy, the y finds itself with an annual charge of £600,000 for interest, king fund, &c., £100,000 for dependants of employees who have ned the forces, and £50,000 for increased wages. Nearly one lf the Corporation staff who are of military age are with the lours; and at least 10,000 persons in the city are rendering ntinuous war service free. Birmingham is doing much more which there is good reason to be proud; and though the time an anxious one, there could have been no more suitable occa n for the city to have as its head a member of a family who ve so long been closely identified with its welfare.

anging Conditions and Habits.

It is remarkable how kindly the public has taken to the kened streets in London and elsewhere, and has soon adapted lf accordingly. The public realizes that the change is but a porary expedient to mystify our unbidden nocturnal visitors, that there is greater safety in the condition than if the rauders had below them a plan of city or town lined-out by and electric lamps. By contrast, the change intensifies (and return from present conditions to the normal ones will do so more) all the public has gained by the progress that has n made in the methods of street lighting, where these methods applied. But the current conditions are the ones that imme ely concern us. Gas and electric supply companies have been ng heavily, owing to the darkened conditions of the streets; the loss has not been counterbalanced by the increased use lluminants in the homes, where people stay after dusk much e than they did formerly. Habits have also altered; and the cause of this is traceable to the need for obliterating the ets as much as possible by the suppression of illumination by et-lamps, and of wayward radiations from the lamps of shops residences. People do not at night time wander in the streets nuch as they did formerly; the theatres and the music halls less patronized; and the public caterers are not doing so well. a stay-at-home period. It, in effect, carries us back (as the ily Telegraph" said some few days ago) "to the era before was introduced into common use for street lighting, with the rence that the population of London is far larger and more ely dispersed than it was. Dickens, Thackeray, Kemble, and Johnson would feel quite at home in the streets in these days, gh they would miss the linkmen and marvel at the motors. y might be surprised at any suggestion that the times were of joint; things would look normal." But we have altered ways since those revered worthies paced the paved ways in about Fleet Street.

pping Hours Reduced at the Dark End.

Another habit of many people that has been changed by of circumstances, is that of putting off shopping at the big oriums until daylight fails. The night attractiveness of these es has been depreciated by the rigorous measures taken to ress the escape of light from windows and doorways on to roadway; and the shaded lamps within are not the best to the efficient conduct of business. Quite a number of the st of the shopping establishments in London have decided ose earlier—one as early as five o'clock, and several at six ck. It is stated that the considerations that have led to this sion have been the safety of the public and the enabling of tants to reach home at a more reasonable hour. We are not , but it would not be surprising, if this new experience does result in a permanent adherence to earlier closing in the rtant trading centres of London—it would certainly produce conomy for the proprietors of the shops if the public ratified action by producing business compensations in the daylight s. Those people who patronize the large establishments in London are not those in poorer circumstances who are often unable to shop until the evening time, and then make their purchases at less imposing shops. But these changes in shopping hours and requirements, which produce economy in lighting accounts, of course hit the suppliers of illuminants very hardly, as do also the changes that have been made in other directions—for instance, in the hours and customs applying to licensed premises. But in the gas industry there have been innovations of a more revolutionary character; and they have been successfully surmounted. At the same time, the loss of business in "lumps" in one direction requires a lot of work in other directions to secure a counterpoise. Fortunately, in the gas industry we have more diversity of application of the primary commodity, cheaper installation and upkeep, and greater economy than our chief competitor can boast of; and so the enforced reduction of lighting patronage is more easily encountered by the one industry than by the other.

Joint Enterprise in Tar Distillation.

We believe that the question of joint enterprise by gas undertakings in the matter of working-up the residual products of gas manufacture will receive extended consideration, and that the idea will materialize. It is not a new subject in our columns, and only recently ["JOURNAL" for Nov. 2, pp. 241, 261], it was revived by Mr. E. V. Chambers, in the paper he contributed to the last meeting of the Manchester Institution. Mr. Chambers hinted that he knew of gas engineers who were deliberating over the matter of putting-down central plants for the rectification and fractionation of the light oils from tar dehydration plants at gas-works, as well as for treating the dehydrated tar. There have been many complaints—and particularly lately since tar-washing came into use, and the quantities of light oils in the tar were considerably increased—that some tar distillers have not been acting justly by gas undertakings. A special article dealing with the increased value of the treated tar was not long ago contributed to our columns, and is worth keeping in view [see "JOURNAL" for July 20, p. 120]. This action of certain of the tar distillers in pocketing an undue share of the increased value serves to enhance the reason why gas undertakings not in a position to have a complete tar distillation plant of their own, should group themselves together for the provision of a central plant. Two or three of these about the country would help those who are anxious to buy the crude material from gas-works to a better appreciation of the desirability of acting fairly.

The Precedent of Germany.

We are not in the habit of depreciating our own country. But in some industrial and commercial matters, it must be conceded that Germany has set us a good example. In the provision of central tar plants by gas undertakings, that country has been before us. Mr. G. S. Hessenbruch has been attracted by the German plan; and so included particulars of it in a paper he recently read before the Missouri Public Utilities Association We have shown on previous occasions that in Germany the gas undertakings do a large amount of co-operative dealing in coal and residual products. In his paper, Mr. Hessenbruch relates how the majority of the gas-works are members of an organization known as the Verband Deutscher Gas Fabriken; and how the gas undertakings have subscribed the capital with which the Association have constructed the necessary plants for dealing with tar and ammonia. The plants are built on a conveniently central site, and of a size determined by the aggregate raw material contributions of the group of gas undertakings. The quantity sent by each gas-works is recorded, and the quality tested, and due note is made of this, and the undertaking profits accordingly. The central plant is run as an organization distinct from the gas undertakings; and from a central office control is kept of all the plants, as well as of the stocks of materials and transactions. This control promotes economy in dealings, and in the transit of the finished materials. The gas undertakings, in addition to the payments received for the crude materials, as determined by quantity and quality, receive (we take it) interest on the capital subscribed to the Association. The gas undertakings are allowed to do just as they please in this matter. There is no saying: "You must not do this, and you must not do that." They do what is best for their undertakings; and through the undertakings, the consumers of gas benefit, as well as those who participate in the profits of the gas concern.

CAPTAIN RICHARD B. G. GLOVER KILLED.

Among the latest casualties on the Western Front, is unhappily included the name of Captain Richard Bowie Gaskell Glover, 1st (City of London) Battalion the London Regiment (Royal Fusiliers), who was killed in France on the 5th inst. Captain Glover was in his 32nd year, and was the younger son of Richard Thomas Glover (late Chairman of Messrs. Glover and Main, Limited) and Agnes Glover, of Bryntirion, Dartmouth Park Road. He was educated at the U.C.S. Preparatory School, Holly Hill, Hampstead; Doon House, Westgate-on-Sea; and Uppingham School. He was a school "prepositor," in the Rugby Fifteen and the Hockey Eleven, and became head of the Cadet Corps. When he left Uppingham, he obtained his Commission in the Royal Fusiliers (T.F.), and volunteered for Imperial Service at the beginning of the war. After five months in Malta, he was sent to France with his regiment. He was a member of the Rosslyn Park Football Club, and a Liveryman of the Worshipful Company of Haberdashers. His Commission as Captain was gazetted in March, 1907, when he had passed the School of Instruction.

His Colonel, writing of him, says: "I would like you to know how much we all loved him. I have known him ever since he joined the Battalion; and the charm of his personality and character, his keenness and strong sense of duty as a soldier, will never, never be forgotten by those of us who knew him and loved him. Oh, he was such a good fellow; and I am sure that there is not a man in the Battalion who does not grieve at his death."

The deceased officer was a popular member of the "Evening Star Lodge," where he was initiated into Freemasonry in 1912.

IN MEMORIAM—M. DELAHAYE.

Appropriately to the first anniversary of the death of M. Adolphe Philibert Delahaye, which falls on Dec. 3 next, an eloquent tribute to Delahaye's genius as technical authority, journalist, and administrator has been published by his colleagues of the Syndicat Professionel of the Société Technique. It takes the form of a *brochure*, briefly recalling the inestimable services rendered to the gas interests in France by Delahaye up to the day of his death.

It is fitting that this appreciation of the talented General Secretary of the Syndicat Professionel should be associated conjointly with the two great French bodies, for Delahaye's incessant labours embraced a wide field. He was a technician of the first rank, but, unlike many technical experts, possessed a mind singularly alive to the problems of business organization, and intensely interested in promoting their solution. The monograph now issued does not perhaps add any facts of Delahaye's life to those mentioned in the notices of his career which appeared in the "Journal" immediately after his death.* But this later tribute does lay special emphasis upon the high esteem in which Delahaye was held in many circles into which he was brought during his twenty years of active work for the gas industry. It is recalled that his interest in lighting sprang from his connection, when about thirty years of age, with several electrical publications. He had invented an electric lamp, or, strictly speaking, a regulator, prior to that of Jablochkoff; and the Exposition of 1881 had caused him to turn his attention particularly to electricity as a source of light, on which subject many extremely able articles appeared from his pen during the next few years.

The time was one in which the gas industry in France was feeling the necessity of girding itself for a struggle with a possible rival. The Directors of the "Journal des Usines à Gaz," established in 1876, were then seeking to appoint an Editor competent to represent the industry and to deal with the changing technical conditions consequent upon Siemens' publication of the principles of thermal recuperation in flames. Attracted by Delahaye's lucid treatment of most complex subjects, their choice fell upon him. He accepted the position in 1885; and from that time onward to the day of his death his energies were wholeheartedly devoted to French gas interests. The mere recital of the posts which he filled is enough of itself to mark the important place he occupied. In addition to the direction of his journal, he filled in succession the chief official positions in the Société Technique du Gaz. On the establishment, in 1892, of the Syndicat Professionel, he became its General Secretary—a post which he retained until his death. In this capacity he spared neither time nor labour in bringing the Syndicat to its present high degree of usefulness to the industry, although for ten years his services were entirely honorary. In addition, he did a great deal of work as an expert for the tribunals of commerce of the Seine; undertaking important duties in litigation, an arbitration connected with electrical competition, damages by explosion, and claims, often unjustifiable, by municipal authorities. His conclusions in connection with improper concessions for electric lighting have been employed as the basis of legal administration; while in a notable case of litigation arising out of alleged damage by electrolysis, it was he who drafted the tests to be made in such circumstances for fixing the liabilities of the respective parties. Work of this engrossing kind did not, however, prevent him organizing the gas sections of the Paris Expositions of 1889 and 1900, nor from acting for years as General Secretary of the International Committee of Photometry.

Amid all these duties, as the memorial *brochure* relates, Delahaye had never allowed himself any relaxation from business—at least, not until the year 1910, when his health for a time gave way. His return to his work at the Chambre Syndicale was made the occasion of a demonstration by his colleagues of their profound regard for him by the presentation of a gold *plaque*. The incident greatly affected M. Delahaye, whose tastes, in the phrase of the oration delivered over his grave, were "*eloignées de tout apparat*."

The last five years of his life witnessed his old activity, save for his retirement for a month each year to his country estate. Germany's declaration of war, we read, caused him physical distress—not at the call of his two sons to the colours, but from the vividness with which he realized the commercial and industrial upheaval in public and private life which a long war would bring. Yet he never lost confidence, nor once left Paris. He had the joy of seeing his younger son completely recovered from wounds received in the early months of the war, and of having himself contributed to the organization of the gas industry for the supply of munitions.

To these records of efficiency, however, must be added the tribute to M. Delahaye's personal qualities. His colleagues write in the warmest terms of his universal and overflowing goodness, of his great sympathy, and of the integrity and disinterestedness which characterized his manifold labours in the different branches of the industry to which he was devoted.

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*Vol. CXXVIII., pp. 590, 654.

Masonic—Evening Star Chapter.

After the transaction of the ordinary business of the Evening Star Chapter 1719 on Wednesday last—including the election, as joining members, of Ex. Comp. A. E. Croager, the W.M. of the Evening Star Lodge, Ex. Comp. Thomas A. Guyatt, and Comp. E. J. Fox, and the exaltation of Bro. Charles Clare—the Principals and Officers for the coming year were elected as follows:—

M.E Z.	Ex.-Comp.	Frederick A. West, P.Z. 1602.
H.	,, ,,	W. Thomson.
J.	,, ,,	Arthur E. Eves, P.Z. 1201.
Scribe E.	,,	Rae P. Normand.
Treasurer	,, ,,	W. A. Surridge, P.G. Std. Br., P.Z. 1719, 1201, 1397.
Scribe N.	Comp.	William Dommett.
P.S.	,,	A. E. Broadberry.
First A.S. . . .	,,	F. W. Cross.
Second A.S. . . .	,,	George Hands.
Organist	,,	C. W. Offord.
Stewards . . .	,,	A. C. Beal.
	,,	W. R. Silk.
	,,	Arthur Valon.

Recovery of Sulphur Dioxide.—The "Engineering and Mining Journal" says that sulphur dioxide may be recovered from gases comparatively poor in it (according to a United States patent No. 1,145,579), by passing the gases at room temperature—say, 11° to 24° C—over charcoal, when the SO_2 is absorbed, and later heating the charcoal to from 130° to 180° C., when the SO_2 is expelled. The enriched gas, which, the inventor states, may occasionally carry even 98 to 99 per cent. of SO_2, is recovered and used. He also calls particular attention to the fact that various charcoals have different affinities for sulphur dioxide, and particularly recommends the use of boxwood.

PERSONAL.

Mr. H. Barton, A.S.A.A., has been promoted to the position f Accountant to the Aldershot Gas, Water, and District Lighting ompany.

Mr. A. M'Alpine, Assistant Manager at Maybole, has been ppointed Manager of the Aberfeldy Gas-Works. There were over irty applications for the post.

At last week's meeting of the London County Council it was eported that Mr. L. W. S. Rostron had, owing to ill-health, ound it necessary to resign his seat on the Local Government o. 3) Committee, of which he had for some time past been hairman.

Mr. John Wilson (son of Mr. Alexander Wilson, of Glasgow), ho is at present Assistant Engineer at the Falkirk Corporation as-Works, has been appointed Chief Technical Assistant to r. James MacLeod, the Engineer of the Greenock Corporation as Trust.

Owing to the resignation of Mr. W. H. Nutter, the Engineer nd Manager of the St. Annes-on-the-Sea Gas Company, on ac- ount of ill-health, Mr. E. Hargreaves, his Assistant, has been ppointed to succeed him. Mr. Hargreaves has been in the ser- ice of the Company for many years, and for the last eight years as assisted in all departments.

Out of thirty-five applicants, Mr. Thomas H. Nield, who is now esident Manager of the Hollinwood Gas-Works, under the ldham Corporation, has been appointed Manager of the Hebden ridge and Mytholmroyd Gas Board. He succeeds Mr. E. J. ellens, who has secured the vacant post at the Grimesthorpe heffield) Gas-Works. Mr. Nield, who is 36 years old, com- enced his career in the head office of the Oldham Corporation as Department, where he received his commercial training. or 8½ years he has been engaged in general works' management; d during the past two years he has been Resident Manager at ollinwood. During this period the works have been practically -modelled; and Mr. Nield has assisted in supervising the erec- on of the largest spiral-guided gasholder in the world, a com- ete installation of vertical retorts of two million cubic feet per y capacity, new purifiers, &c.

LECTRICITY SUPPLY MEMORANDA.

Frightfulness.

OME representatives of the electric supply industry at one time ied to make capital out of an occasional gas mishap. Gas-ovens sed to be illustrated exploding, with Mary Ann, cutting a very undignified figure as she was making exit (at considerable velocity and inconvenience to herself) through window or door. ooms looking like scrap heaps were also portrayed as having een put into that condition by explosions of gas, and as being a equent condition of homes in which gas was used. The public ughed at all such nonsense; and statements and illustrations id no harm whatever. The public is wise enough to appreciate at, with care, there need be no accident with gas; and it has so realized the fact that electrical accidents, which frequently sult in death, are covered with too much mystery to be pleasant. ow "Meteor" naturally forgetting that the "Electrical Times" as ever so stupid as to have had anything to do with fomenting e use, by electric undertakings, of the form of "frightfulness" ferred to above (which, when applied, left the public unper- rbed), now says: "The day is long past when competitors of ectric lighting could frighten householders by tales of live con- ctors and the slaughter of innocent children." We are not ware that gas undertakings ever made use in their local trading erature of tales of "live conductors and the slaughter of inno- nt children," though there is not the slightest reason why innocent children" should not be slaughtered by electricity as ell as innocent men—as a matter of fact, there are incidents on cord of malfeasance on the part of electricity in connection ith which children have been among the victims. But we go to read that "even the 'fusing of electric wires,' we think, falls dull ears nowadays. The public easily swallows a brand new , but will only yawn at an old one." Then electric wires do t fuse. They never have done so. To say so was at one time a brand new lie;" now it is "an old one." This is very curious. here is something wrong between our recollection and experi- ce and "Meteor's" assertion. Next we shall have the Germans ying that they never sank the *Lusitania* with its multitude innocent men, women, and children aboard, nor that they have er sent Zeppelins to London to indiscriminately murder men, omen, and children, and to wreck private property and homes.

Facts—Not Lies.

Trouble with gas is a comparatively rare occurrence; death due to electricity is a pretty frequent happening. Of course, Meteor" may choose to say that this is also an "old lie." He ay call it just whatever he likes; but people are really not such ses as to fail to recognize facts, even when an electrical writer pleased to wrongly classify them. There was a soldier killed cently by electricity at the Military Camp at Richmond, as the sult of a "practical joke," which should have been described as a "murderous joke." Within the month of October, there are on record at least five deaths due to electric shock. Early in the month, T. E. Green, aged 24, an employee of the South London Electric Supply Corporation, Limited, was found lying over a live wire, with his clothes on fire, in one of the cells into which he had gone to dust the insulators. Death resulted from shock and syncope due to the burns. A little later, at the works of the Lancashire Ordnance Company, Heaton Norris, a workman received a fatal electric shock. A motor was being lifted with chain blocks; and one of the chains came in contact with a cable running on an insulator close by. At the point of contact with the cable, the insulation had worn away. The pressure was said to be about 286 volts. Near the same time, E. M. Jackson, an electric lamp trimmer, in the employ of the Islington Borough Council, climbed an electric arc standard to trim and recarbon the lamp. He suddenly fell from the top of the lamp to the ground. Both hands of the poor fellow were found blistered. At South Shields during the month, Horace Smith, employed by the British Electric Arc Welding Company, came in contact with some live metal, and was found unconscious with a V-shaped burn on his neck. Towards the end of the month, an Italian—Matteo Simeone—was killed at a restaurant at Neath. A brass rail ran round the counter; and this rail was connected to an electric wire, with the idea of producing fun at the expense of anyone who happened to touch the wire. Simeone caught hold of the rail; his feet at the same time came in contact with an iron plate in the floor; and a circuit was established. Simeone will never again be a party to any practical joking with such a dangerous fluid as electricity. It was stated at the inquest by an electrician (Mr. J. Wesley Evans) that the voltage in the supply mains was 220; but 30 volts was the maximum obtainable where deceased fell. Then it is reported that, on Oct. 31, at the Military Hospital at Richmond, through an electric cable fusing, one nurse received burns and another had a severe shock. How would "Meteor" describe these occurrences? As "lies"? Perhaps the true meaning of the word has escaped his memory.

Tariffs and a Minimum Charge.

Electricity consumers never will understand the principles—there are a great number of them—on which charges are made for electricity; and, therefore, the professors of mathematical accuracy in formulating tariffs (the rateable value one, for example) had better save their time, and give up as hopeless all attempts at making consumers appreciate the soundness of their proceedings in this regard. The electrical profesion started their tariff-making work with a fair show of reason for utilizing in it a heavy batch of factors. But they had to forsake the righteous way which they had planned, and renounce scientific rule, in order to obtain heating and cooking custom—irregular, and helping to form peaks and declivities in the day output curve—by charging ½d. and 1d. per unit for current so used. The load factor and all else had to go by the board in order to do this. Then came the rateable value system, which finally rejected all principles and factors, made trading in electricity nothing short of a gamble, and inflicted upon consumers all sorts of irregularity in their payments for the service rendered—causing in some cases charges per unit in excess of the maximum, and setting up in others a system of preferential treatment in defiance of the statutory regulation. The tariffs of the electrical industry supply the results of a most unhappy and confused mixture of effort, and a confession of the trading conditions in electricity being irreconcilable with a sensible and plain system of charging. Householders have been asked by Mr. Asquith and others to economize; and electricity consumers are economizing among other people. One such lately wrote to a morning paper, complaining of the conduct of the electricity company supplying his house. This frugal one has been saving every pennyworth of current possible; and the company have put in a claim for the minimum charge of 13s. 4d. per quarter—equal to 20 units at 8d. They are within their legal right (as was lucidly explained by Mr. Runciman when the matter was raised recently in the House of Commons); but the consumer, in consequence, cannot see what is the good of complying in this particular with the appeal of Mr. Asquith and the economists, if 13s. 4d. a quarter is to be paid to the electricity suppliers although current is not consumed to that amount. One morning contemporary sought out an electric lighting official for an explanation, and that worthy admitted that some electricity consumers "are cutting-down their bills so low that it is not worth while supplying them." He gave the obvious advice that the consumer can change from an ordinary to a prepayment meter, or he can cease to take a supply for the present. If such consumers do not pay the undertaking through an ordinary meter, they will not do so through a prepayment one. Anyway, those householders who find a grievance in the minimum charge for electricity should be informed that in the trading of the gas industry there is no minimum charge; business being conducted on the same lines as in other commercial transactions—the charge made being for only the gas consumed, and not for a cubic foot more or less.

A Legal Opinion.

Practically throughout the electricity supply industry, charges have had to be increased, owing to abnormal circumstances resulting from the war. The legal contributor of the "Electrical Review" has been discoursing on the subject of the powers that exist in relation to the making of the increased charge. He is against municipal suppliers trying to foist upon the ratepayers the additional costs occasioned by the war. This legal contributor knows something about equity; and he sees the Local Government Board standing at the junction from which diverge the right and wrong ways in this matter. "The fact that 'profit,' so-called, was written off against the rates in the piping times of peace is not likely to persuade the Local Government Inspector to make the ratepayer pay the loss accruing owing to the war." There is a nasty sting about the words "profit, so-called." Many electricity supply undertakings, as we have previously pointed out, have taken the short cut to making compensation for increased costs by adding from 10 to 20 per cent. to all accounts. A sudden percentage increase, he says, cannot be legally defended as a way of reducing losses; but notice must be given to each consumer that, at the end of his current contract, he will be charged at the added rate—the operation being then perfectly legal, provided all consumers are treated alike. "No preference" must be shown "to any consumer or class of consumers." Thus the lighting rate must be raised uniformly in the district, and the power consumers, as a class, must also be similarly treated. He refers to the maximum prices allowed by the special Provisional Order, and adds: "So long as the statutory limit is not exceeded, electric supply undertakers—whether local authority or company—may charge what they like by agreement." To this may be added that it is subject to the provision as to no preference being shown, and the observance of the one as to "like circumstances." The Long Eaton, Ilford, and South London cases gave the electricity industry some valuable lessons in legal interpretation.

Salvation of the Electric Lighting Business. "Lux" has been writing for the "Electrical Review", an article headed "Half-Watt Lamps from the Central-Station Standpoint." The article also deals with matters other than the half-watt lamp; but, when treating of the new comer, the truth is not told in ascribing to it an efficiency of 1 candle power per half watt. It is said that "a 2000-candle power half-watt lamp . . . consumes 1 KW." If it is a 2000-candle power lamp actual, it consumes more than 1 KW.; if a lamp only consumes 1 KW., it is not of 2000-candle power. Beyond this, the mean spherical candle power of the lamps is 20 per cent. below the nominal candle power, which is measured on the horizontal. However, "Lux" is anxious to administer comfort to the central station engineer over the coming of the half-watt lamp. The metallic filament lamp has been the salvation of the electric lighting business; for all the old and foully slanderous broadsides that used to be directed against gas, could not have prevented people from preferring economy to the heavy claims on the pocket that the carbon filament lamp made through its gross inefficiency. The metallic filament lamp came just in time to prevent a fearful slump in the electric lighting business. But central station engineers then shivered. Here was a lamp which gave a candle power (say) for 1·5 watts per hour, against 4 to 5 watts by the carbon filament lamp. Then came the half-watt lamp in large and medium sizes. Again the central station engineers shivered. They see a rapid decline in consumption. But they are asked to be of good cheer. The half-watt glare projector fills a vacant space between the ordinary metallic filament lamp and the flame arc lamp. People, we are told, like it for advertising purposes. Its economy will secure large new adherents. Its economy, too, makes it possible to use the lamps with indirect or semi-direct fittings, and obtain the same illumination at the same cost, as with the bare metallic filament lamps. Central station engineers need no longer shiver. They must look at these things in the true perspective. With the new lamps, "Lux" assures the engineers, everything is going to blossom in the lighting line for electricity, to the disadvantage of other illuminants. Of course, things are not going to be quite as smooth sailing as that; there are other points besides the single one of current consumed. But it is excusable to omit mention of them when the idea is to show that all is well with the electric lighting business in relation to the central station output.

Heat Losses. "Lux" shows that the electrical process is a prodigal one in squandering heat units right away from coal heap to lamp or heater; and this fact he thinks indicates that there is plenty of scope for further raising the efficiency of electric-lamps. Electricity stations must live; and it is probable that, if there is any more efficiency gained in electric lamps, this will have to be added to the other factors which have fallen upon the concerns—increased cost of coal, apparatus, fittings, labour, rates and taxes, and so forth—and help to advance the charge that the undertakings have to make per unit for lighting purposes. However, the figures are interesting that "Lux" gives as to the heat inefficiency of the electricity system. Here they are: "Of the full energy equivalent of the coal pile, only about 70 per cent. reaches the inlet valve of the turbine in the form of steam. About 80 per cent. of this energy is lost in converting it to mechanical power, so that we are left with about 14 per cent. of the energy of our coal pile available at the turbine shaft. The efficiency of converting mechanical to electrical energy and distributing the latter is very high, so that we still have 10 per cent. of the energy of the coal pile available at the lamp terminals. Of this, carbon filament lamps convert only 2 per cent. into light, while metal lamps convert 6 per cent. into light, and the half-watt lamps convert some 10 per cent. of the energy into light."

Heating at 2d. per Unit! An optimistic "Wholesale Supplier" of electric-heaters has been writing to the "Electrical Review" on the subject of the attitude of local authorities towards electric heating. We are told by this disinterested person that electric heating is becoming more and more universal throughout the country; and he is surprised to find any local authority going out of their way to retard its progress. The effect of this policy must be felt by the local contractors, the wholesale suppliers, and the manufacturers. The optimist goes on to say that he is convinced now that coal is at such a high price, and the gas authorities intend to raise their charges still more per 1000 cubic feet (we had not heard of this before), that "electricity even at 2d. per unit can make it worth while for the ordinary consumer to instal an electric fire." We are glad "Wholesale Supplier" pitches his ideas no higher than one electric fire in view of the 2d. per unit. We hope he will go on siding with the 2d. per unit; and that other electrical people will follow his example. There is not much business in electric heating at ½d. per unit—not even with the new incandescent bar fires. Quite a lot of electricity per hour has to be consumed in very cold weather in an ordinary room to make one feel a proper degree of comfort. Continuous heating by electricity may suit the pocket of Lord Tom Noddy, but not of ordinary individuals.

SULPHATE OF AMMONIA FOR WHEAT.

In the course of a letter which appeared on p. 324 of last week's "Journal," explaining the arrangements which have been made between the Board of Agriculture and the Sulphate of Ammonia Association, by which manufacturers will reserve a supply of manure for autumn top-dressing, Mr. D. Milne Watson (the Chairman of the Association) stated that the Board were issuing immediately a pamphlet recommending farmers to use sulphate on wheat. Copies of this [Special Leaflet No. 46] are now obtainable on application to the Secretary, Board of Agriculture and Fisheries, No. 4, Whitehall Place, S.W.; but it is intimated that the President of the Board has appointed a Committee to make arrangements for the supply of fertilizers, and farmers who have any difficulty in securing supplies of sulphate of ammonia at the agreed price should communicate with the Secretary of the Committee at No. 3, St. James's Square, S.W. The arrangement come to between the Board and the Sulphate of Ammonia Association is that the reserved supply will be sold during November and December at prices not exceeding £14 10s. net cash per ton f.o.r. at the makers' works, in bags, in lots of 10 cwt. and upwards.

As to the advantages of this top-dressing, the Board, in the leaflet, remark that experiments at Rothamsted may be accepted as sufficient to establish that, if prudence be exercised in applying nitrogenous manures, so that they are used on suitable soils and at proper times, there is good reason to anticipate an increase of one sack [240 lbs.] of wheat per acre as the result of an application of 1 cwt. of sulphate of ammonia in the late autumn, and a further increase of one sack per acre as the result of an application of 1 cwt. of sulphate of ammonia or 1⅓ cwt. of nitrate of soda in the spring. On this basis, they make an interesting calculation. There are now 2 million acres under wheat in this country; and assuming that the crops on about a million acres are suitable for top-dressing, and that the season proves moderately favourable, the application of nitrogenous manures as described would result in the addition to the 1916 crop of a million quarters of wheat. This being so, they point out that, if applied with discretion, the profits from dressings of 2 to 2½ cwt. per acre of a nitrogenous manure, partly in autumn and partly in spring, should be substantial; and at the worst, in the event of the coming harvest year proving very unfavourable, there is not likely to be any considerable loss, with good judgment and proper application.

The leaflet, which states the case for autumn top-dressing well, concludes with a number of suggestions as to quantities of manure for an acre of land, for the guidance of those who intend to use sulphate of ammonia in the manner referred to.

Labour at Power and Light Works.

It has been brought to the notice of the Minister of Munitions that the working of many munition factories is being imperilled by the difficulties now being experienced by gas companies and electric supply companies, which provide them with power and light, in retaining a sufficient staff for their immediate needs. The Minister desires to point out that such companies are engaged upon work of vital importance, and that the removal of their employees, even to munition work, may frequently have the effect of prejudicing the output of munitions of war. He would at the same time invite employers to assist him in the matter by refraining from attracting labour from these essential undertakings.

The death occurred on the 11th inst. of Eliza Harper, widow of Mr. Joseph Bennet (Messrs. Alder and Mackay), of Edinburgh. Deceased was buried yesterday, in Morningside Cemetery.

The Council of the Institution of Civil Engineers announce that—starting with to-night—the time of the ordinary meetings will, owing to possible disorganization of traffic in present circumstances, be changed temporarily from 8 p.m. to 5.30 p.m.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS & MANAGERS

THE General Meeting of the Association was held last Thursday, at the Hotel Cecil, Strand, W.C., under the presidency of Mr. J. W. AUCHTERLONIE, of Cambridge. Probably in view of the papers on the dehydration of tar and the informal discussion on the "C" process, there was an extraordinarily large attendance of members.

LOSSES TO THE INDUSTRY.

The PRESIDENT said, before starting the proceedings, he thought he ought to briefly refer to the loss the industry had sustained by the death of two very prominent members. He referred to Mr. Edward Allen and Professor Vivian B. Lewes. Mr. Allen was a member of the Association; and, by reason of his many visits to London, he was frequently able to attend their meetings. He was in that room only at the last meeting; and he then took part in their proceedings with his usual vivacity and keenness. He was in the forefront of the *personnel* of the industry; and his counsel was always very much appreciated at any of the meetings of professional organizations. Professor Lewes was an eminent scientist, an able chemist, and a great authority on gas manufacture, as well as, as they were all aware, on the processes of industries of many other kinds. He (the President) thought they all looked upon Professor Lewes as a personal friend; and certainly, with his commanding presence, his charming personality, and his wonderful fluency as a lecturer, he was at once an education and a joy to listen to. In the name of all the members, he thought he could say that they mourned the loss of these two gentlemen. The Hon. Secretary had already sent a message of sympathy with Mrs. Allen; and he (the President) thought the members might wish to show their respect for these two departed ones, and at the same time support the action the Secretary had taken, by silently rising in their places.

This was done.

MINUTES.

On the suggestion of the HON. SECRETARY (Mr. H. C. Head, of Winchester), the minutes of the last meeting were taken as read.

ELECTION OF OFFICERS.

Mr. A. E. BROADBERRY (Tottenham) said it afforded him great pleasure to propose as President for 1916, Mr. W. Doig Gibb. [Applause.] He was sure it was unnecessary for him to make any lengthy remarks to recommend Mr. Doig Gibb as President. The applause that greeted his name showed how well he was respected by the whole of the members; and it was sufficient to say that the members felt, while they were doing Mr. Gibb the biggest honour in their power, they would be appointing a gentleman as President who would reflect a great deal of honour on the Association itself.

Mr. J. WESLEY WHIMSTER (Bath), in seconding, said he was sure the Association were honoured by having such a man as Mr. Doig Gibb as President. They knew that he would uphold the dignity both of the office and of the Association.

The PRESIDENT congratulated Mr. Gibb upon his return to better health.

The motion was cordially passed.

Mr. DOIG GIBB (who was received with applause) thanked the members very much for the honour they had done him electing him as President. A month or two ago he had very grave doubts as to whether he would accept the office; but pressure was then brought to bear upon him by the Committee, and their kind words of encouragement decided him to accept the position. He only hoped that he would be able to keep up its high traditions and, when it came to his turn to congratulate his successor, that he would be able to turn over the office to him as solid as he himself would take it from Mr. Auchterlonie's hands.

Mr. D. H. HELPS (Reading) proposed that Mr. W. N. Westlake be elected Vice-President, and remarked that he was certain that when that gentleman came to fill the higher position, he would do so with dignity and advantage to the Association.

Mr. P. P. CHANNON (Hayward's Heath) seconded the proposition, which was unanimously carried.

Mr. W. N. WESTLAKE (Exeter), in replying, said there were times in one's life when one felt grateful for compliments that were paid to one. He thought he ought to feel more than usually grateful for the honour the members had done him. Though he entertained some considerable doubt as to whether he should fill the office as Vice-President to the satisfaction of the members and of the generous friends who persuaded him to accept it, he would do his best. No man could do more. When he came to his year in higher office, he hoped the members would be completely satisfied.

Mr. W. H. BENNETT (Redhill) proposed, and Mr. P. DREWETT (Farnham) seconded, the election of Mr. Frank Livesey as a member of the Committee.

Mr. F. W. CROSS (Lea Bridge) moved, and Mr. W. B. FARQUHAR (Ilford) seconded, the election of Mr. A. A. Johnson (Brentford) as a member of the Committee.

Both proposals were heartily carried.

Mr. C. F. BOTLEY (Hastings) proposed, and Mr. THOMAS PRICE (Walton-on-Thames) seconded, the re-appointment of the Hon. Auditors (Messrs. J. L. Chapman and A. Dougall).

This having been agreed to,

On the proposition of Mr. W. E. PRICE (Hampton Wick), seconded by Mr. L. TREWBY (Mill Hill), Mr. Head was re-appointed Hon. Secretary and Treasurer.

The HON. SECRETARY acknowledged the continued confidence of the members.

ADDITIONS TO THE MEMBERSHIP ROLL.

The HON. SECRETARY then read the names of the new candidates for membership: Mr. Cyril Towers, of Hythe; Mr. H. J. Randall, of Yorktown; Mr. J. Taylor, of Weston-super-Mare; Mr. W. E. Dean, of Exmouth; Mr. L. H. Eady, of Southampton; Mr. J. W. Whimster, of Bath; Mr. G. C. Offord, of Petersfield; and Mr. J. H. Donaldson, of Sevenoaks.

The PRESIDENT moved that these additional eight gentlemen be elected members.

Mr. ARTHUR VALON (London) seconded the motion; and it was unanimously carried.

REPORT OF THE COMMERCIAL SECTION.—THE WESTERN DISTRICT.

The HON. SECRETARY said it was hardly worth while taking up the time of the meeting in reading the report of the Commercial Section. He was going to hand a copy of it to the Technical Press to print with the "Transactions" of the meeting. He should, however, like to allude to the accounts. During the year, the section had very nearly paid its way. It had reduced its balance by £2; but this was more than accounted for by the donation of ten guineas to the Prince of Wales' Fund. Before concluding his short announcement, he should like to make mention of yet another matter, which came before the Association and the Commercial Section, but it appealed to the latter more than to the former. In September last, the Committee had before it a letter signed by Mr. James Armstrong, of Ilfracombe (a member of the Association), in which it was suggested that several members of the Southern District Association, resident in the West of England, were desirous of having a Western District Commercial Section. A Sub-Committee was appointed to deal with the matter, and a meeting was held at Exeter, at which it was decided to recommend that the Commercial Section do hold quarterly meetings in the western portion of the southern district. The members for whom Mr. Armstrong wrote were very emphatic that they did not wish to sever their connection with the existing Commercial Section; and it was felt the course recommended was the best method of meeting their wishes. It was understood that this method commended itself to western members. The members of the Commercial Section should make this known as widely as possible, and so ensure for the meetings in the west an unqualified success as soon as they commenced.

The report of the Committee of the Commercial Section was as follows:—

> The Committee have pleasure in submitting the sixth annual report of the section, for the year ended Sept. 30, 1915.
>
> *Membership.*—During the season one member has resigned, and two have joined; the total number of members now being sixty-three.
>
> *General Meetings.*—Twelve general meetings have been held during the season; the average attendance being sixteen members.
>
> *Coal.*—During the period under review, the questions of supplies and prices have, owing to the war, given cause for anxiety. At one period, the position of many companies became, owing to depleted stocks and congestion of the railways due to Government requirements, so perilous that strong representations were made to the Government for assistance. This, due largely to the good offices of the Railway Executive, was forthcoming. Seaborne coal was practically unobtainable, and then only at greatly enhanced prices. This promptly re-acted on the Yorkshire and other fields, and increased prices all round.
>
> In the autumn of 1914, the prices ruling were about 1s. per ton below the prices at the corresponding period in 1913; but later the figures very materially increased—up to 5s. and 6s. per ton. The reasons given by the colliery owners for such large increases were, the restricted output owing to miners joining the forces, the increased cost of production, and the advanced rates for seaborne coal.
>
> With a view to curtailing the unwarranted inflation of prices, a Bill was introduced into Parliament, limiting the increase in the price of coal at the pit's mouth to 4s. per ton over 1913-14 prices. The Bill became an Act in July last; and under it buyers who were being charged in excess of the limit could appeal for a reduction in the sanctioned prices. The desirability of lodging such appeals had been a matter of much consideration and discussion; and many buyers have thought it undesirable to take advantage of the Act.
>
> *Coke.*—At the commencement of last winter, fairly large coke stocks were held at many works, prices were accordingly low, and large quantities were sold forward. The shortage of coal in the winter, however, made a great demand on coke; and high prices were obtainable. Companies holding large stocks unsold were amply repaid for their forbearance.
>
> The Committee note with great regret the incompleteness of some of the fortnightly returns, and must urge all to make regularly complete returns, and fulfil their obligations to their fellow members.
>
> *Tar.*—In order to secure to the Ministry of Munitions all the light oils, &c., from the tar produced at gas-works, orders were issued to all

road authorities that only dehydrated tar should be used for road purposes. This prohibition placed many companies who were not in possession of dehydration plants and who usually sold their tar for road purposes in a very awkward position, both in the matter of storage and finance; the disposal of the tar at a much reduced rate to the distillers being in some cases rendered necessary. Since the order came into operation, many dehydrating plants have been ordered; but the delivery of these is being greatly delayed owing to the demand for direct Government requirements. The Ministry is, however, taking steps to secure the delivery of plants on order without further delay.

Sulphate of Ammonia.—Since the beginning of the war, there have been opportunities for introducing this fertilizer into overseas markets which were previously obtaining supplies from Germany. No effort will be spared by the Sulphate of Ammonia Association to establish the English product in these markets; and there is little doubt that they will succeed, provided the British product is of a higher standard. The desirability of a guaranteed 25 per cent. of ammonia is urged.

A scheme is on foot for regulating the sale of sulphate of ammonia in the country districts by fixing a minimum price for farmers and dealers in each area. This, it is felt, will do much to assist undertakings in disposing of their sulphate of ammonia locally. Those undertakings which are not already members of the Sulphate of Ammonia Association are strongly advised to join. Apart from any other reason, the increased price which the Association has enabled sulphate of ammonia makers to obtain repays the subscription many times over.

The Board of Agriculture intend making during the autumn and spring strong representations to farmers in the British Isles to use sulphate of ammonia, in order to increase the production of cereals and other food stuffs. The Sulphate of Ammonia Association has been approached with a view to fixing prices at works for sales up to the end of the year. It is hoped the efforts of the Board of Agriculture will prove a success.

British Commercial Gas Association.—The Committee feel that there is nothing futher to be added to the appeal contained in the last report; but they are happy to be able to state that during the past year the names of several companies in the South of England have been added to the already long list of subscribing undertakings. The British Commercial Gas Association is carrying on its valuable work in a most satisfactory manner; and the use of such an Association has never been greater than at the present time. Any member who is connected with an undertaking which does not already belong to the Association is asked to use his best endeavours to secure its support.

War Service Badges.—This subject was discussed at more than one meeting; and at the request of certain members orders were placed by the Committee for a supply. This was before the issue of official badges to munition workers. It is now understood that the private badges issued under authority are withdrawable under the terms of the Munitions of War Act, 1915; but notice under the Act has not been issued by the Ministry of Munitions.

Numerous subjects have been discussed from time to time at the meetings—among them being: Price of light oils, wages at works, &c., discounts on steam tubes, price of B.O.V., badges for gas-works' employees, slot installations, coal supplies, tar for road treatment, war bonuses, coke contracts, retort carbon, &c.

Signed on behalf of the Committee,
H. C. HEAD, *Chairman.*
October, 1915. R. SEYMOUR TOBEY, *Hon. Sec.*

Mr. WESTLAKE moved the adoption of the report; and, Mr. D. T. LIVESEY (East Grinstead) having seconded, the motion was unanimously carried.

EDUCATION OF GAS-FITTERS.

The HON. SECRETARY reported, in relation to the question of the examination of gas-fitters, that a copy had been received from the City and Guilds of London Institute of the report of their Examiners. This report, which it was hardly necessary to read to the meeting, would be printed in the "Transactions." Speaking generally, the report indicated the necessity of the better education of gas-fitters. The thanks of the Association were due to the various members who kindly assisted the Association by acting as Examiners for the practical tests, or appointing assistants to act in that capacity. Most of these gentlemen had kindly consented to act again next year. The City and Guilds of London Institute stated that examinations would probably be held next spring in the following towns: Norwich, Newmarket, Exeter, Wandsworth, Salisbury, Cambridge, Ilford, and London. At the request of the City and Guilds of London Institute, letters had been sent to the managers of the gas companies in various towns asking them to arrange that classes in gas-fitting be held in their respective towns during the ensuing winter. In some cases, this has been possible; but in others, owing to the present conditions, managers had not found it possible to comply with the request. The gentlemen who consented to act as Examiners were:

NORWICH	Mr. W. H. Wayte, British Gas Light Company, Bishop's Bridge, Norwich.
NEWMARKET . . .	Mr. J. H. Troughton, Gas-Works, Newmarket.
EXETER	Mr. F. Caudwell, Gas-Works, Exeter.
WANDSWORTH . .	Mr. H. A. Wall, Gas-Works, Wandsworth.
SALISBURY . . .	Mr. N. H. Humphrys, Gas-Works, Salisbury.
CAMBRIDGE . . .	Mr. H. Sword, Gas-Works, Cambridge.
ILFORD	Mr. F. Ainsworth, Mr. H. S. Collister, Mr. T. Hurry, Gas-Works, Ilford.
LONDON	Mr. J. Hewett, 39, St. Asaph Road, Brockley. Mr. S. B. Chandler and Mr. H. Baldry, South Suburban Gas Company, Lower Sydenham. Mr. P. J. Smithers, Gas Light and Coke Company, Horseferry Road. Mr. B. W. Brooks, Gas Light and Coke Company, 146, Goswell Road, E.C.

TWO PAPERS ON TAR DEHYDRATION.—See pp. 373-7.

Two papers were then read—one entitled "Some Notes on the Working of a Continuous Tar Dehydration Plant," by Mr. Frank Livesey, of Maidstone, and the other "Notes on Tar Dehydration," by Mr. R. Wardell, of Tottenham. It was proposed that the discussion on them should be taken together with the private informal discussion on the production of toluene which was on the *agenda*. This was done; but the remarks almost entirely related to the latter subject, and those few which touched solely upon the papers cannot well be separated from the remainder. Among the speakers was Mr. F. L. Halford, of the High Explosives Committee, who put forward the point of view of the authorities regarding the gas industry and the war. At the close of the discussion,

The PRESIDENT said he was afraid the discussion had rather drifted away from the papers. He would ask Mr. Doig Gibb to propose a vote of thanks to the authors.

Mr. W. DOIG GIBB remarked that it was a pleasurable duty to propose a hearty vote of thanks to the readers of the two papers which formed an excellent introduction to the interesting and lengthy discussion they had had upon the all-important question as to the best way to help on the war. Their thanks were equally due to the other two gentlemen—Mr. W. D. Child and Mr. Frank Durkin—who had been kind enough to prepare papers for the meeting. He was sure they were too patriotic to feel any resentment on account of their papers having been crushed-out by the discussion on toluol. He had every sympathy with them on the postponement of the papers, because it would make his own task the easier when preparing the programme for the next meeting—seeing that the papers were already in print, and it would be unnecessary to get promises for them. [Laughter.]

Mr. A. E. BROADBERRY (Tottenham), in seconding, said that the discussion they had had on the subject of toluol extraction and tar dehydration had been so interesting that they had all been thoroughly engrossed in it. If the readers of the other two papers felt any regret at not having had an opportunity of submitting them to the meeting, he was sure the members generally also regretted not having had the pleasure of listening to and discussing them. Personally, he had been much looking forward to these papers, and was glad to think it was only a pleasure postponed.

The vote of thanks was then put to the meeting, and carried by acclamation.

THE TWO REMAINING PAPERS.

The references by Mr. Doig Gibb and Mr. Broadberry were to two other papers which had been prepared for the meeting, but which there was no time to present—on the "Construction of Concrete Purifiers at Romford in 1913," by Mr. W. D. Child, and a "Short Description of the Carbonizing Plant at Southampton, and Results Compared with Previous Years," by Mr. F. Durkin, of Southampton.

The PRESIDENT said it had been suggested that the two papers still on the *agenda* should be taken at the next meeting. It was felt that this would be the better course, as they were well worthy of discussion. He would be glad to know whether the members agreed to it.

Mr. F. W. CROSS (Lea Bridge): I suggest that they should be circulated before the meeting.

The PRESIDENT: There is no reason why we should not do that.

Mr. W. E. PRICE (Hampton Wick): May I suggest that it might be possible perhaps to arrange for the discussion of the other two papers also to be taken at that meeting? I am sure some members would have liked to discuss them to-day who have not been able to do so.

The PRESIDENT: That can be considered.

The proceedings closed with a cordial vote of thanks to Mr. Halford for his presence at the meeting, and for the information he had given them.

Disguised German Mantles.

Under the heading "Flying False Colours—German Gas-Mantles show the Stars and Stripes," last week's issue of "John Bull" remarked: The 'cuteness of the German trader is beyond question; and he is as impudent as he is artful. We have an example in front of us. It is a square cardboard case, used in the packing of gas-mantles. Three sides of it are occupied by as many representations of the American flag—the stripes in red and white gaiety, the stars in sober blue and white. And across each flag are the two words, "The American." The object plainly enough, is to conceal the true origin of the gas-mantles Closer examination reveals, on the bottom of the cardboard case the words (in very small, unobtrusive type), "British Patent;" and we have to own, on the principle of giving the devil his due that the words "Made in Germany" appear on the side of the case. They are not printed, but are added with an india-rubber stamp, as though by an afterthought. The whole intent is to deceive, and it is cleverly done; for the "Stars and Stripes" o "Old Glory" make a most effective design, though probably the people of the United States would not be proud of this misuse of their national banner. The article is in good condition, and looks like new stock. We learn that these German mantles, passing under the American flag—as do other things Teutonic—have been and are being, used by one of the large gas companies.

COKE-OVEN MANUFACTURERS' ASSOCIATION.

Meeting in Sheffield.

The First General Meeting of the Association was held in the all of Applied Science, Sheffield, on Saturday, when the business as an address by Mr. George Chrisp (the President), of the alton Main Colliery, on the "Development of the Bye-Product nd Coking Industry of Great Britain."

Mr. Chrisp said that in this present time in the history of the ountry it might be thought that the energies of the industry ought be devoted entirely to the problems of the present rather than e past. The Council of the Association, however, had thought, ith him, that they should have some data put together in view future use. There was no doubt that a history of the industry ould have to be produced some day; and an address of this escription, embodying a careful collection of data, so far as had een possible, would be expected to arouse a certain amount of iscussion, out of which might be expected to come some addi- onal data for the help of the future writer, whoever he may be, a proper history of the industry. In the present conditions, ich data were being rapidly lost, and a serious effort must be ade to preserve them.

The author pointed out that the beehive oven is really a bye- roduct oven—its bye-product being waste heat for steam raising. his oven is acknowledged to be still the producer of better coke om some coals than the retort, though the retort-oven is able to oke certain coal that the beehive cannot use. The early progress the new oven has been slow—perhaps due to the fact that abun- ant supplies of fine coking quality coal are available in this coun- y, whereas abroad the beehive oven is unable to deal satisfactorily ith much of the low-coking grade coal found. By the use of the tort-oven, with outside quenching appliances, the heat of the alls is retained, so as to make full use of the small quantity of sible elements present.

Clovis Knab, a French engineer, designed the first retort-oven, nd erected a battery in 1856. In 1861, Henry Simon (the founder Messrs. Simon Carvés, Limited) became interested in Knab's ven, and, in conjunction with F. Carvés, introduced side heating es. The early difficulties experienced with coke users were not nfined to prejudice; but gradually improvements were effected the quality of coke produced, and the rising prices of bye-pro- cts assisted to arouse interest. Attempts were made by owners beehive sets to adapt their plants to meet developments by the covery of bye-products. Aitken in Scotland, and Jameson in ngland, made moderately successful efforts in this direction, a system of perforated conduits or "grips" in the floor of the ven, through which the products were drawn and recovered. The troduction in 1883 of Simon's recuperator was a distinct improve- ent; and this type was largely adopted in this country, with modi- ations, for nearly twenty years. The vertical flued regenerative en then began to assert itself. Coppée had built vertical flued ens in Belgium as long ago as 1861 and here in 1873; but the tto Company appear to have been the pioneers of the modern en of this type.

After detailing the relative advantages and disadvantages of generative and non-regenerative types of ovens, Mr. Chrisp lded that the decision of firms in choosing the type most suitable r their purpose is largely influenced by their particular require- ents in waste heat or live gas for power and lighting. He then scribed the various ovens, commenting upon their outstanding atures, and referred to the introduction of the compression achine by the Simon Carvés Company in 1900, and by Semet- lvay shortly afterwards, to the improvement in the coke pro- ced (in the way of higher yield, &c.). Mention was also made various improved coke-handling arrangements, and a descrip- on given of the early practice in ascension-pipes, mains, and rculation, and the evolution of present methods therefrom.

After this, Mr. Chrisp came to the subject of ammonia recovery, e development from the "indirect" to the "direct" system, and description of intermittent and continuous methods of treating quors. He alluded to Bolton and Wanklyn's patent of 1882 for rect ammonia recovery, and stated that Koppers "semi-direct" ocess was the one from which the present "direct" methods ave been evolved. He then described Mackenzie's patent of 14*—oxidizing the sulphur compounds to SO_3 by means of ides of nitrogen + steam = H_2SO_4, which reacts on the ammo- a in the gas to form $(NH_4)_2 SO_4$.

The vital importance of benzol recovery was emphasized; it eing remarked that the intermittent process is now almost dis- ntinued, the continuous system being capable of higher yields, minimizing losses in circulation. A *résumé* of progress made as followed by some comments on the evolution of the coke-oven anager, his adaptability to changing and progressive conditions, c., the need of the new Association, and the opportuneness of e present time for the movement.

Mr. Chrisp added that the coke-oven industry was being con- cted in England before it was in Germany; the first plant in is country being at Port Clarence, Middlesbrough. In a brief ference to Durham coal, he mentioned that he remembered ving one sample of this coal which produced coke weighing lbs., but which, with a compressed charge, produced 80 lbs. of ke on the same size of coal. If there were any members who could correct him with better data which could be introduced into the address for future reference, the Council would welcome such corrections. They desired to place the historical part of the Association upon a good basis.

Mr. T. B. Carr remarked that, in regard to direct recovery, Mr. Chrisp had spoken of Koppers being the originators of this system. He assumed, of course, that the speaker had meant in England. He believed Branck was the first on the practical scale in Germany.

Mr. Chrisp agreed that this was so, so far as his own knowledge went.

Mr. T. H. Riley, referring to the stamper at Monkton, said this had been started about 1900; the machine having been ordered from Germany three years before. It was of the first type, and many times it broke down. To continue making charges they had had to have wooden mallets, and do the whole of the stamping by hand.

The President remarked that it was very interesting to have among them that evening, in Mr. Riley, the man who had actually been the first to be in charge of the first machine of this kind in this country.

Mr. F. Cooper said the President had said something about the first ovens in this country being at Stillington. There was an old installation of bye-product ovens at Micklefield. He was wondering if this had not been the first.

The President replied that the Micklefield plant was not a success, owing chiefly to the unsatisfactory nature of the coal, both from the coke and the bye-product points of view. There had been no tar worth speaking of, but a curious yellow oil. This plant was begun in the year 1885.

The Hon. Treasurer (Mr. B. W. Haigh), in proposing a hearty vote of thanks to the President, said he thought the Association had made a very excellent beginning, not only from the point of view of the *personnel* of the President, but of the number of members whom they had already gained in association with them. He understood there were about 104 coke-oven plants in the country, and for their membership to number half of the managers spoke well of the prospects of the Society. They seemed to have, indeed, come into being at a most opportune moment. The Government, he thought, was never so much inclined to recognize the industry as at present. It was undoubtedly regarded as a very important industry at such a juncture in the history of the country. There were certain modern developments of the industry to which the President had not referred; it was impossible to include every phase in a half-hour address. The development of power at collieries was one important feature where coke-ovens were now being used. The gas-engine feature was an important one; and very large installations of gas-engines were now, and had been for some time past, successfully at work, producing a considerable proportion of power at the collieries. He did not think he was giving away any secret in saying that a million cubic feet of gas per day was now being supplied to the Leeds Corporation by a certain coke-oven plant in their area. Another highly important point which they should bear in mind was to see that the products they turned out were all of the very best quality. In years gone by, there had been complaints—not without justification—that the sulphate produced in the English works was not equal to that manufactured in Germany. By means of hydraulic extractors and other methods, he believed most English works now turned out a sulphate which contained 25 per cent. of ammonia. Mr. Chrisp had referred to the importance of producing every possible ounce of benzol, and he (Mr. Haigh) believed the Council had already arranged for the Association to have, in the near future, a paper on this subject. He did not think he was wrong in saying that at the present moment the highest source of toluol for high explosives was the coke-ovens. He believed all the benzol now produced was being used for the manufacture of synthetic phenol, which was turned into picric acid for explosives. He understood that no benzol was now allowed to be used for traction purposes.

Mr. J. Marshall seconded the proposition, and said he could not but admit that he had learned a few things from the address, despite his own years of experience in the coke-oven world.

The motion was carried unanimously.

The President, in replying, said it had been a very real pleasure to him to get out the data for the paper. In doing so he had found a good many things he did not previously know himself. [Laughter.] The difficulty of getting reliable data had been very great. The information supplied to him by the various coke-oven companies had been so extraordinary that he had had to get it out in lumps. He would still welcome criticism or correction if any members would care to write to him. They, as an Association, would some day be asked to furnish a history of the coke-oven and bye-product industry.

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* See "Journal," Vol. CXXXI., p. 403.

Occupations from which Enlistments Should be Restricted.—The Board of Trade announce that an inter-departmental advisory Committee are engaged in preparing lists of reserved occupations—*i.e.*, occupations from which enlistments should be restricted, in view of the necessity of maintaining the trade of the country as far as possible. Representations from employers with reference to indispensable and irreplaceable classes of labour should be addressed to the Secretary, Reserved Occupations Committee, Board of Trade, Gwydyr House, Whitehall, S.W.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

A well-attended meeting of the Association was held last Friday evening, at the Westminster Technical Institute, Vincent Square, Westminster—Mr. S. B. Chandler (of the South Suburban Gas Company), the President, in the chair.

Development in Gas-Fires.

The business consisted of a lecture, by Mr. H. Hartley, Chief Chemist to the Richmond Gas Stove and Meter Company, entitled the "Development of Gas-Fires, 1913-1915." The lecture [which will be found in full on pp. 382-8 of this issue] was illustrated by lantern slides, and various practical demonstrations; and one of the firm's "R.H.D." bow-fronted fires was in operation on the platform. The author dealt with his subject in an extremely lucid manner, and the members gave their closest attention to all he said and did.

The President, in introducing the lecturer, pointed out that his reputation was of the best; and the members were justified in anticipating something good from him as the result of the great amount of research work that he had done. At the conclusion of the lecture, he remarked that the Association were honoured by the presence of Mr. Thornton, the Managing-Director of the Richmond Company; and perhaps he would be good enough to say a few words.

The Gas Industry and Capital Restrictions.

Mr. H. M. Thornton said he should have preferred first of all to hear any observations on the lecture that members might have to make. It was, of course, rather difficult for him to criticize the lecture; and he did not think that he should try, even if it appeared to him desirable. Mr. Hartley had traced the history of gas-fire construction during the last few years; and it must be obvious to all those present that a very great deal of important work had been done in the laboratories of gas-stove manufacturers. Possibly the amount of this work had surprised many of the members. The stove-makers were very modest; and what they did, they seldom spoke about. [Laughter.] Even if they did speak about it, they did so in such terms that not one of them in the business seemed to know what the other meant. But leaving all this aside, one could not fail to be struck by the different position occupied to-day by what was called the "trader"—he did not think it was a nice word—in relation to the professional element in the gas industry. The change that had come over the whole scene in this respect the last five to ten years—the desire manifested to co-operate, to work together, but to go ahead as one complete body—had been one of the most pleasant features of the industry. They could safely say that the breaking-down of this barrier—which he hoped would never be replaced—had been of vital importance, and splendid in result to the whole of the industry. The members had heard what his firm had been doing in their own particular works; and he hoped they had been interested in the facts which the Company were glad to have had an opportunity of bringing before them. Perhaps they would pardon him if he broke away from the lecture for a moment or two, to touch upon another very important subject. Unfortunately, the country was at war; and possibly it was likely to be for some time to come. What was the position of the gas industry to-day? They had just heard of the wonderful changes in gas-fire construction, which had brought them to the time when they could go to the consumer with perfect confidence and place a gas-fire in every room of the house, knowing that the result was going to be satisfactory from every point of view. Thus they had a splendid opportunity for obtaining new consumers; and in a pamphlet issued by the Parliamentary War Savings Committee the public had been asked to use more gas. Why? Because in this way they would produce the very materials which were needed for the successful prosecution of the war—particularly the toluol which was employed in the manufacture of high explosives. As he had said, they were told in this pamphlet to use gas; but unfortunately they were not told how to raise the funds to provide the requisite apparatus to carry out to its fullest possible extent this very sensible suggestion. The Treasury, on the one hand, said: "You must not raise capital;" the Parliamentary War Savings Committee, on the other hand, said: "Please consume as much gas as you can." Statements had appeared in the Press lately with reference to a deputation (which arose out of a letter he wrote to the British Commercial Gas Association), who waited upon Lord Moulton's deputy on the High Explosives Committee. The deputation was received with every cordiality, and great appreciation was shown of the facts adduced. The position on this point, therefore, was being considered; and they hoped for a satisfactory result with regard to obtaining sanction to raise funds for the purpose of buying apparatus. Some gas undertakings were fortunate in being provided with capital; and therefore they were able to go on as usual.

THE QUESTION OF RECRUITING.

But he thought that an industry with millions of capital at stake, like the gas industry, which was also of obvious importance to the prosecution of the war, required to be put on a proper basis with regard to a very much more important factor. Assuming that they had the money, their men were leaving their employment willingly to join the fast-swelling ranks of the army. They were all proud that it should be so, and that the industry was taking so splendid a part in the national crisis. But they were now coming to a point at which they required a decision. Perhaps it might be thought that he was speaking selfishly; but what was right for the manufacturers was right for the industry as a whole. They could not separate themselves. What he asked for was guidance on the point of how far this recruiting in connection with the industry was to proceed. He believed the matter was under consideration; but he wanted to know, if the men were essential in the works where gas was made, were they essential further on than this? Were they essential to the fitting of the apparatus? and essential to the manufacturers of the apparatus? Was it desirable from the point of view of the country that these men should give up their employment? Guidance was needed; and the matter was of such importance that he ventured to refer to it now, although it had nothing to do with the lecture. If they knew it was necessary for the men to go, they would all, he was sure, be willing to make the utmost sacrifice. But they were told the country was short of toluol, and more gas must be made and sold; and they could not do this if they lost the men for the manufacture and fitting-up of apparatus. As time went on, they would find more men gradually leaving; and a period might arrive when the gas consumption would go down, and when they might be left in a very difficult position with regard to the production of essential war materials.

GAS-STOVE CONSTRUCTION.

He was afraid he had not added very much to the discussion; but he did feel that they had arrived at the point in gas-stove construction when many of their friends would exclaim: "Defend us from any further alteration." But he did not think the time had come yet when they could stay their hand. It was a most fascinating subject; and the work that was being done with regard to research on the construction of fires and other apparatus was obviously not going to cease yet awhile. In fact, he did not think it would be to the interest of the industry that it should do so. They had to provide apparatus which would be the most satisfactory to the consumer, if they were to retain their position. By doing this, they would ensure a great future for the industry to which they were proud to belong.

A Vote of Thanks.

The President said he was sure they all thoroughly appreciated what Mr. Thornton had said. He had put the case for the gas industry very clearly. They had heard a brilliant lecture from Mr. Hartley, who must be regarded as one of the first of gas research men. He had no doubt to some extent upset a good many of the theories held by members with regard to gaseous heating. Probably some of them had had the idea that almost any modern gas-fire would give them at least 75 per cent. efficiency—roughly, 50 per cent. in radiant heat, and 25 per cent. of convection. This, for one thing, had been rather upset.

Mr. W. A. Vanner (Walton-on-Thames), in proposing a hearty vote of thanks to Mr. Hartley, said the lecture had been full of interest from beginning to end. They all fully appreciated the thoroughness with which he and the Richmond Gas Stove and Meter Company had put before them the results of their scientific investigation.

Mr. F. C. Briggs (Gas Light and Coke Company), who seconded, remarked that one had gained during the last few years notions about the gas-fire which had been knocked on the head by Mr. Hartley. The lecture would be most valuable; and they would ponder carefully on the points brought out. In this way, they would learn a good deal more from it than from a lecture which simply confirmed what most of the members might already believe.

Mr. Hartley, in acknowledgment of the vote (which was accorded with acclamation), said he had only touched upon work which had actually been done in the firm's own laboratories; and it bore in all its aspects, he thought, on the developments of the last two years. There was represented in the digest that he had given them a very large amount of research. It would be perfectly obvious to them that he, as an individual, had not done all this work, and the thanks they had given him were in part due to his staff, because it had only been possible by their aid to collect and interpret the facts which had been put forward in the lecture. In addition to the loyalty of his staff, he was much indebted to the firm under whose auspices he worked for the opportunity of investigating these problems so thoroughly. In a manufacturing concern, when one started out upon an investigation, the work could be split up under two heads. One was out to attain a certain object. One wanted to find the "how," and having done so, often had to stop. But it was very hard to stop at this point, because one's training made one want to know the "why." In this ventilation problem they had tackled, he thought they had been perfectly conscientious in striving for the "how" and the "why;" and it was for this reason he had felt particular pleasure in the opportunity of expounding the work to the members. He was glad to have provided food for reflection; and he hoped it would not be thought—and he did not believe it would—that his object had been to expound the firm's particular make of gas-fires against any other patterns. He had tried to explain his firm's reasons for their designs; and where they had clashed with other views, he had stated why these other views had not been adopted.

MIDLAND JUNIOR GAS ASSOCIATION.

Opening Meeting of the Eleventh Session.

It has already been mentioned that the Association have been ompelled, by force of circumstances, to arrange a much shorter rogramme than usual this session; and of the few meetings that is intended to hold the first took place on Saturday afternoon. the Technical School, Suffolk Street, Birmingham—Mr. F. J. VARD (of Knowle), the President, in the chair.

OFFICIAL CHANGES.

The PRESIDENT, in opening the proceedings, said that, as the iembers were aware, Mr. H. E. Stone, who was Treasurer of the ssociation, had left Birmingham to take up a position at Birkenead. The Council had congratulated him on his new appointient, and wished him success in his future career. Unfortuately, they had also lost Dr. Davidson, who had been a tower f strength to the Association. He was always ready to give them f his best. Whenever the Association required special informaon on any subject with which Dr. Davidson was familiar, he as pleased to give it. He had left the gas profession for another xtremely important industry; and while regretting losing him, ieir very best wishes went with him.

A SHORT ADDRESS.

The PRESIDENT then addressed the members shortly; pointing ut, in the first place, that when he delivered his Presidential ddress a year ago, he did not at all anticipate being requested continue in office for a second term. Events had, however, onspired to render such a course, in the opinion of the Council, esirable. The curtailment of the programme had been rendered ecessary owing to the impossibility of asking members to preare papers, or arranging for the Association to be received at orks as visitors, at a time like the present, when every member as fully occupied in performing his part in providing, light, heat, d power for the community—a task which was, of course, ade heavier by the absence of such a large number of gas ficials with the Colours. The members of the Association had sponded gallantly to the call for service; upwards of thirty eing now with the Forces. Unhappily, too, they had to mourn e loss of a very promising member, in Second-Lieutenant E. W. lenkinsop, formerly of Leamington and Warwick, who fell bly doing his duty. While hoping they would not lose any ore members in the same way, they were quite sure all would equally ready to meet the call if it came.

Turning to works topics, he remarked that, though the extracon of toluene from gas was being successfully prosecuted generly, it was not possible for all works to undertake it by the usual ocess—particularly those very small ones which were unproded with an exhauster and the necessary plant. In the case works which possessed only sufficient apparatus to deal with e extraction of ammonia, it was obviously impossible to carry t toluene extraction without providing and fitting-up additional ant—a difficult thing to do in these days of labour shortage. creased expenditure of motive power was entailed by the workg of a toluol extractor; and in his own works he could not adopt e process until he had laid down a larger engine—the one in use eing barely sufficient for other needs. Should toluene extraction undertaken with insufficient washing plant, resulting in some mmonia being unextracted, where oxide of iron revivification *in u* by the air process was practised (in which case there was ways a quantity of free oxygen unutilized passing forward from e purifiers), the problem would arise of considerably increased idation of service-pipes and iron internal house pipes. He was mself trying to discover how to avoid this difficulty, which was centuated when the meters used were wet ones; the rust being en damp, and difficult to eject from the pipes.

The supply and price of coal was giving them serious concern; d unfortunately the Act which was hurriedly passed to limit the ice was practically a dead-letter. If it were possible to force e coalowners to accept the prices laid down by the Act, they rtainly could not, without legal resort, make them keep up those pplies, or maintain them at the required quality. It was a ism to state that the less competition there was in the sale of al, and consequently the higher was the price paid, the less gard had the suppliers for keeping up the quality. In times of d trade, the coal received was always of good quality—being tter screened, washed, or picked than at other periods. The esent times were having a very varied effect on the sale of gas different localities. Where the military were stationed, or where unitions were manufactured, there were considerable increases sales, and in some cases difficulties from lack of labour and ant were being experienced; while in almost entirely residential stricts like his own, decreases were universal. Lessened public hting, earlier closing of premises, change of habits of consumers, d general economy, were all having their effect; and increases the prices of cookers, fires, fittings, &c., tended to prevent their creased use. They must wait patiently for the clearing of the rizon, for regaining lost ground and securing fresh business.

Continuing, the President said the improvements which had en made within the last three or four years in the method of rning gas in fires, had caused a large increase in this line of siness; and the recent adoption of silent burning was one of the greatest forward steps made. There remained, however, many points which could be improved upon. The radiants usually had horizontal or inclined bars and an upright stem in front, which seldom became white hot, and therefore detracted considerably from the appearance of the fire. Were these removed, leaving only side and back stems, with horizontal or inclined bars and larger studs, the appearance would be much enhanced. The bogey of unconsumed gas, through flames playing on obstructions, was of no account, as in two or three minutes combustion was complete, when the studs became heated. A hotter flame than was usual with the newer burners was also necessary, to cause a better glow. In connection with fires, he referred with pleasure to the circular fire introduced lately by Messrs. R. J. Rogers and W. E. Cadwallader, who are both members of the Association. This fire, which he remarked was in request, was described on p. 127 of the "JOURNAL" for July 20.

Another direction in which improvement would be welcomed, added the President, was in connection with the ovens of gas-cookers, so as to prevent the products of combustion coming in contact with articles cooking, and also to obviate the splashing of grease on to the oven-walls. He suggested that young members of the Association engaged in cooker work might well look into these matters, and not accept the present type of cooker as finality. These and many other problems were awaiting solution; and they must be ever ready to seize and act upon any inspiration for effecting progress, and thereby assisting in securing the well-being of the human race.

Mr. R. G. MARSH (Birmingham) proposed a hearty vote of thanks to the President for his address, and for consenting to remain in office for a second year.

Mr. J. POULSON (Stafford), in seconding, remarked that they generally found the President struck out a line for himself; and on the present occasion his reference to the increased oxidation of service-pipes under certain conditions showed how acute he was in looking after small matters.

After the vote of thanks had been cordially passed, and acknowledged,

The PRESIDENT called upon Mr. E. Stroud, Chief Engineer to the Holophane Company, to deliver a lecture on

MODERN ILLUMINATION AS APPLIED TO GAS LIGHTING.

Mr. STROUD began by remarking that while, with the present lighting restrictions, it might seem rather inopportune to introduce a discussion on good lighting and efficient methods of illumination, it was a fact that lighting had been perhaps one of the most discussed of the minor subjects during the past few months. In some respects, the changes which were taking place as to the shading of extraneous light, and the re-directing of the rays where they were necessary, had been advocated by illuminating engineers for many years. Some shop windows in the past had had brilliant unshaded light-sources placed more or less directly in the line of vision—thus obstructing a view of the goods they were meant to illuminate. In the case of street lighting, similar conditions existed. Spot lighting was generally to be found, which, while illuminating parts of a street with excessive brilliancy, left other portions in comparative darkness.

Until lately, the method adopted for the reduction of lighting in London was the obscuring of the upper part of the existing lanterns, leaving the lower portion transparent. But this, though it achieved the object of obscuring from view the surrounding buildings, allowed an extremely bright patch of light to be thrown directly on the ground surrounding the standards. This excessive contrast from the apparent bright spots to absolute darkness, left much to be wished; and in the new lighting order, dated Sept. 28, a desire was expressed for more even illumination in streets. To this end, the lower portions of the lamps were now matted, so as to afford a more diffused distribution; and at the same time the upper portions of the lanterns had in some cases been treated with semi-transparent distemper, to avoid excessive contrasts.

These methods being extremely inefficient, lighting engineers were devoting their attention to devising suitable refracting and diffusing globes which would throw the light along the streets without allowing it to pass in an upward direction. With shop-windows, the object had been achieved in various ways—for instance, by placing coloured material around the lights, or actually painting the lamps and reflectors, so as to allow just a small amount of the light to be directed on to the goods. The most successful method so far adopted, however—at one and the same time meeting the regulations and giving the most efficient lighting to the goods—was the use of concealed lighting. This was undoubtedly the most reasonable plan to adopt for any window. The light reflected into the street depended, of course, on the character of the goods—the lighter the goods, the greater being the reflection.

The reduction in lighting necessary should naturally be determined by the heights of the adjacent buildings, and the width of the thoroughfares, as it was obvious that, with very high buildings and narrow streets, there would be a very limited angle at which it would be possible for hostile air-craft to locate the light. Both for the sake of shopkeepers and the safety of the pedestrians, it was desirable to get the maximum illumination permissible; and to the lighting engineer the solution seemed to be that a certain maximum foot candle illumination on the streets should be stipulated by the authorities, taking into account the local conditions

The lighting engineer would be only too pleased to co-operate with the authorities to this end.

The lecturer went on to remark that there was one aspect of illuminating engineering which did not come under the ban of restriction, and that was the lighting of factories. With thousands of factories working day and night in the production of munitions, &c., it was of paramount importance that the lighting should be arranged in a proper manner. There were also many new factories in course of erection; and it would seem a wasted opportunity if the lighting was not laid out on the most up-to-date and scientific lines. The present was, in fact, an unprecedented time for the skill of the lighting engineer. So important, indeed, was this matter of factory lighting, said Mr. Stroud, that the Government some time ago appointed a Committee to go into it; and he drew attention to their recently issued report [which, with the evidence given before the Committee, has already received full notice in the pages of the "JOURNAL"]. This document, he said, was extremely interesting, and showed that the authorities were now taking into account lighting conditions, just as they did heating and ventilation. With large factories there was an enormous scope for high-pressure gas systems, on account of their extreme efficiency, and the few points it was necessary to instal in order to get the desired effect.

Proceeding to explain concisely the methods of obtaining from the bare crude sources the finished product (in effect, the illumination on the working plane), Mr. Stroud described the photometric or polar curve—the graphic representation of the light distribution. By means of a photometer, the intensity of light from a given source could be determined for various angles, these usually being in a vertical plane through the lamp axis; and the intensities obtained, expressed in terms of the candle-power, could be plotted in such a way as to convey a clear idea of the manner in which the light was emitted. He threw on a screen slides showing the distribution of light obtained from an upright and an inverted gas-burner, as well as from electric lamps. He pointed out that, in the case of the upright gas mantle and ordinary tungsten lamp, the maximum candle-power was given out in the horizontal direction, with great diminution in the vertical; while with the inverted gas-burner and gas-filled electric lamps, the candle-power was approximately the same over the lower hemisphere. It would, on consideration, be seen that it was impossible to design any source that would give the greater portion of its light in the direction in which it was needed—namely, within a zone of 60° above the vertical. Some system of reflection must therefore be employed to obtain the desired results in practice; and by means of prismatic glassware, it was possible to throw the light in any predetermined direction. Then, again, owing to the extreme brightness of modern sources, it was generally necessary to diffuse over a larger area, so as to reduce the intrinsic brilliancy. This could be effected by prismatic glassware, or opal, satin finished, or sand-blasted globes.

The next portion of the lecture dealt with illumination calculations, the whole basis of which, Mr. Stroud pointed out, was that light varies inversely as the square of the distance. The unit used for the measurement of illumination—the foot-candle—was explained; and the illumination formulæ given in the paper presented by Mr. V. H. Mackinney and himself to the Midland Association of Gas Engineers and Managers in the early part of this year [see "JOURNAL" for March 16, p. 661] were quoted. The foot-candle, he said, was the illumination obtained on a surface 1 foot away from the light-source which was of 1 candle-power when it was at right angles to the light-ray. The same light-source of 1 candle-power at a distance of 2 feet would have to cover an area four times greater than at 1 foot; and as it was covered by the same quantity of illumination, the intensity must be one-quarter. It was, however, added by the lecturer that the calculations to which he had referred need not trouble the ordinary individual, as all reputable illuminating firms issued curves and data drawn in a practical form; and it was only necessary to abide by their spacing rules, &c., to get the desired results. He exhibited and showed the working of a "Holophane Lumeter," which enables one to measure the illumination of practical installations to a great degree of accuracy. This the members saw is an extremely portable piece of apparatus, which can be carried and used with the ease of a small camera.

There was also thrown on the screen during the lecture the table, given with the Midland Association paper already alluded to, of average foot-candle intensities recommended for various purposes; and attention was drawn to a table, published on the same occasion, showing that, while direct illumination calculations did not take into account the effect of surroundings, it was possible to obtain as much as 80 per cent. increase if the surroundings were very light. In ordinary practice, however, it was usually safe to allow for an increase of 25 per cent. Emphasis was laid on the importance, in designing lighting installations, of ensuring that shadows are not cast which would prove objectionable.

Slides were shown giving some installation data as set out and published by the Holophane Company, as well as a number of excellent examples of gas street and shop lighting; and after the lecture members were able to examine a selection of specimens of Holophane glassware.

The PRESIDENT proposed a hearty vote of thanks to Mr. Stroud for the lecture, and to his assistant, Mr. Tye. It was almost impossible to at once absorb matter like this, so as to readily ask questions upon it; but there was one commercial point which had struck him. They were all aware that glass had risen very much in price; and he would like to know whether this was the case with the Holophane Company's goods. He was in possession of the firm's catalogues; and though undoubtedly the glassware was worth the money, it was sometimes difficult to persuade consumers of the fact. Another thing about Holophane glass was that it seemed to retain a certain amount of dust.

Mr. F. A. JENKINS (Leamington) seconded the proposition, which was passed with acclamation.

Mr. STROUD, in acknowledgment, said the subject of illumination was a very absorbing one; and the more it was gone into, the more important it became. It seemed a shame that lighting should be installed in the haphazard way one saw. They did not find heating and ventilation carried out in the same loose manner. These requirements were properly specified; and the lighting should be treated similarly. His firm had glassware for which they claimed certain advantages; but at the same time they were engaged in "spreading the gospel" of illumination. The prisms would collect more dust than a clean surface; but it must be remembered that dust did not affect them so much as some other types of globes, while in any case they contended that it did not affect them more than other glass. It had been necessary to put their glass up 10 per cent.; but he would like to point out that nine-tenths of their ware was made in England, and the remaining one-tenth in America.

This concluded the formal business of the meeting.

VISIT TO THE PERTH GAS-WORKS.

Members of the Scottish Junior Gas Association (Eastern District) on Saturday afternoon paid a visit to the Perth Gas-Works, over the inspection of which a couple of hours were profitably occupied.

A feature of interest was a verbal description by Mr. A. R. Wilson of the tar plant—particularly the new dehydration apparatus, which has just been completed. Mr. David Vass, the Corporation Gas Engineer, also gave the visitors some information on the same subject. The members were afterwards entertained at tea in the Windsor Restaurant.

The tar distillation plant consists of two independent systems—an intermittent plant for the working-up of tar to the pitch stage, and a dehydrating plant, worked on the continuous principle. The latter has just been put into operation; while the former was installed twelve years ago.

The intermittent plant consists of two stills, each of 1000 gallons capacity; and each still is complete with condenser, receiving box, and pitch bed. Heat is obtained by means of a coke producer—a system which allows of easy regulation. Refined tar or pitch can be made by this plant at will, although the bulk of the trade is done in refined tar.

The continuous process plant, which has been erected by Messrs. Hird, Chambers, and Hammond, is capable of dehydrating six tons of tar per twenty-four hours. It consists of a rectangular shaped still with vapour pipe connected to the condenser, also a heat exchanger for recovering some of the heat from dehydrated tar.

The crude tar is pumped to an overhead storage tank; flowing thence by gravity to the condenser, where it receives a preliminary heating by cooling the hot vapours from the still. It then enters the heat exchanger, which consists of a tube within a tube; the crude tar entering the inner tube and being further raised in temperature by the heat of the dehydrated tar which is passing through the outer tube. Entering the still, the tar is made to traverse this twice by means of a baffle-plate, when the dehydration is completed. Leaving the still, the dehydrated tar passes on to the outer tube of the heat exchanger, after which it is run to the storage tank.

The still is heated by a Goodrich and Hamlyn pressure furnace, fired by breeze; the hot gases being conducted (locomotive boiler fashion) through the body of the tar, in three 5-inch diameter tubes. The depth of tar in the still never exceeds 14 inches; so that plenty of free space is left for frothing, and a boil-over cannot occur. Once the plant is started, it requires very little attention; but, of course, the heat must be kept uniform.

In designing the plant provision has been made for the addition at some future date of units for the complete distillation of tar up to pitch.

The pension granted by the Metropolitan Water Board to Mr. William Morris, the late Engineer of the Kent District (whose death, in his eightieth year, was recently recorded in the pages of the "JOURNAL"), was £1215 8s. per annum. He left estate of the gross value of £28,267.

At last Friday's meeting of the Metropolitan Water Board the Finance Committee reported that an award had been made in the arbitration proceedings between the Board and the Corporation of Hertford, with reference to the Hertford sewage-works, and included the estimates (amounting to £33,373) in their report. They have arranged with the Hertford Corporation for payment of £25,000 of the award to be deferred until six months after the declaration of peace. In the meantime, interest at 4¾ per cent. per annum will be paid on the amount. The Corporation originally claimed £48,141; while the Board offered £20,673.

THE SOUTHERN GAS ASSOCIATION PAPERS.

READ AT THE MEETING, THURSDAY, NOV. 11.

SOME NOTES ON THE PARTIAL DISTILLATION OF TAR IN A WILTON'S CONTINUOUS STILL.

By Frank Livesey, B.A., Assoc.M.Inst.C.E.

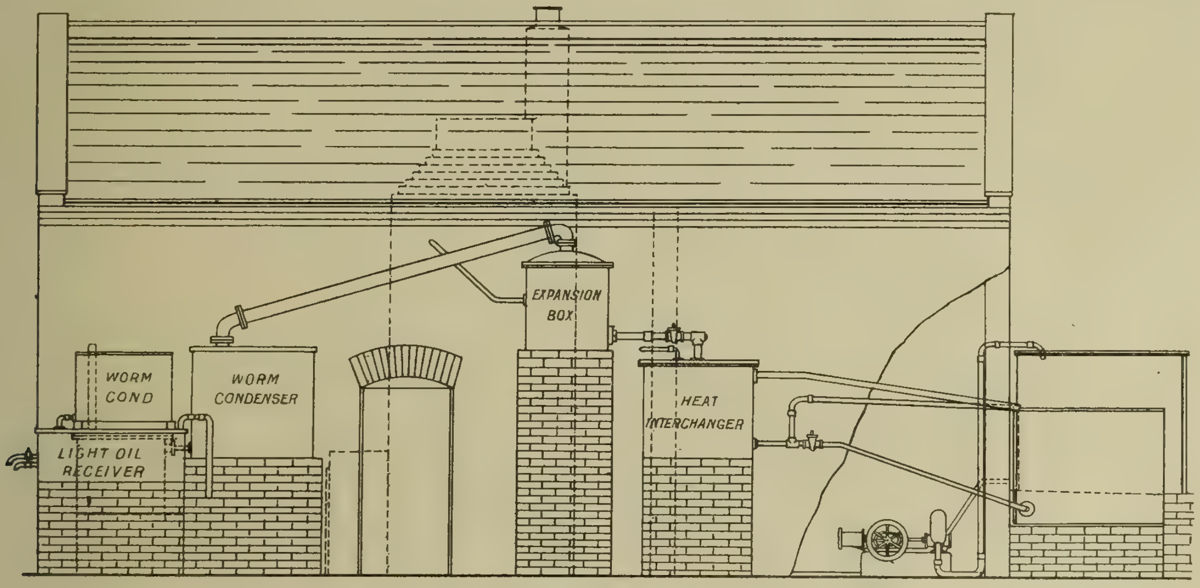
At the present moment a large number of medium-sized gas-vorks have just installed, or have on order, some form of tar-lehydration plant. I thought, therefore, that a short paper on ny experience at Maidstone with a Wilton plant might prove f interest to some, and in all probability promote a profitable liscussion.

At Maidstone for many years a not satisfactory feature of the arbonizing methods has been the large water content of the coal ar produced. I am speaking of the time before stoking machinery nd heavy charges had been adopted; and at this period it was ound desirable to work off in 4¾ hours charges of 336 lbs. of coal er stop-end retort of 10 feet in length. One of the results of these ight charges at high temperatures was a high free carbon content of the tar—never below 18 per cent., and on occasions rising to no less than 30 per cent. Although the tar after leaving the tar-towers was passed through two separators, the free carbon hung tenaciously to the liquor, with the result that the coal tar not infrequently contained 15 per cent. of liquor.

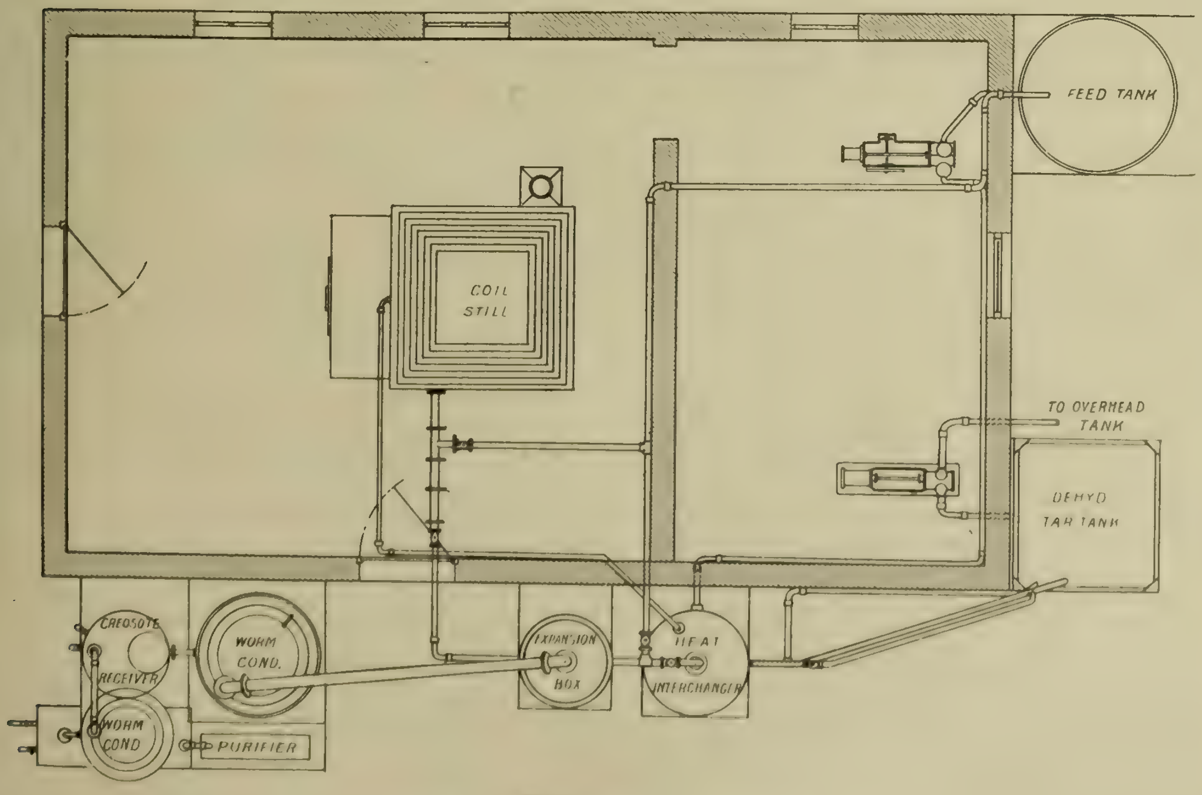
Our coal tar when rubbed with a knife on a piece of glass gave up the liquor with readiness; and this led us to experiment with passing the tar through a machine consisting of two pairs of machined rollers fitted with scrapers to remove the tar. This machine showed some promising signs; but the difficulty in forcing the tar between the rollers at a sufficient speed caused the abandonment of experiments in this direction. As we have only one tar and liquor well, it is our custom to mix all our coal tar and carburetted water gas tar which contains 25 to 40 per cent. of water.

Description of Plant.

In the spring of 1911, after having found that all efforts to completely dehydrate our mixed tar with steam coils were useless, we put down a Wilton plant of a capacity of 4000 gallons of crude tar per twenty-four hours. The plant consists of a feed tank of



Longitudinal Section.



Plan.

THE WILTON DEHYDRATING PLANT AT THE MAIDSTONE GAS-WORKS.

550 gallons capacity, heat interchanger, cast-iron coil-still consisting of twelve circular coils 3 feet diameter and 2-inch bore expansion box, from which the tar flows to the heat exchanger, and thence to the finished tar-tank. From the expansion box the vapours pass through a cast-iron worm condenser and thence to the light oil receiver.

The various vessels are arranged as shown on the illustration. The still is placed in a brick and tiled building to protect it from the weather, and also to shelter the man engaged in operating the plant. At night time this is important; for since the operator can get his meals in comfort, he has no temptation to leave the plant. At the far end of the building a space is shut off by a wall for the two pumps.

One of the pumps is used to force the tar from the feed tank through the plant; and the operator, when firing-up or sitting down to his meals, can see the fly-wheel of the feed pump. It is thus never allowed to stop, as stoppages in time lead to the pitching of the coil. The other pump is for pumping the treated tar from the receiving tank to an overhead boiler for loading purposes. This boiler is of 5000 gallons capacity, and is fitted with a steam coil for cold weather.

The division wall was provided to protect the pump in case of fire, and enable the operator to safely get to the pumps and shut off the tar supply. We have experienced a small fire on the plant, and these provisions justified themselves.

The furnace is fitted with Wilton's forced draught; and from the back of the furnace a central uptake leads the gases to the top of the coil, whence they pass down the annular space and up the flue.

After a short experience of the plant we found that, when working at a temperature of 130° C. in the tar, we were unable to extract our water content. This content was high, and some 4 or 5 per cent. of water remained. The steam-blast was increased to the maximum which the flues could deal with. We found that the crude tar was not leaving the heat interchanger at more than 60° C.; and so between the heat interchanger and the still we added a steam-heater, consisting of an old oil carburettor. This brought up the temperature of the tar to 100° C. before entering the coil, and enabled us to keep up a temperature of 150° C. at the outlet of the coil with an output of 3000 gallons per twenty-four hours.

When the plant was first installed, we laid a 2-inch pipe from the top of the oil-receiving box to our foul-gas main at the inlet of the exhauster—a distance of about 40 feet; but this arrangement was found to be unsatisfactory, owing to the deposition of ammonium salts in the pipe. It was also found that working at 150° C. the condenser provided was insufficient to cool the vapours sufficiently on entering the vapour catch-box.

A small washer, consisting of a cast-iron tank with a perforated dip-pipe running its complete length and sealed about 2 inches in the liquor, was provided; and a vent was furnished from this washer to a small oxide purifier. This arrangement worked satisfactorily for some time, and prevented loss of ammonia; and when working up to 150° C., we were able to run off cool liquor to the well.

In the district round Maidstone, large quantities of Kentish ragstone are quarried. This is a limestone containing from 70 to 90 per cent. of carbonate of lime, and when treated with tar is a most valuable material for road and path work. A good demand exists in the neighbourhood for a refined tar suitable for the purpose. The tar should be free from ammoniacal liquor, the free carbon should not exceed 16 per cent., the middle and heavy oils should be left in the tar, but the naphthalene content should not be too high.

Tar produced during carbonization at low heats is usually preferred; but this is chiefly because the free carbon content is satisfactory. In our case, heavier charges of longer duration have reduced this to the required figure; but, in pursuit of the other features, I determined to work at higher temperatures, and for some time past the plant has been worked at 170° C. in the tar. This necessitated alterations to the condensing plant; and a second condenser was therefore installed between the washer and the vapour catch-box.

A stream of water is run into the bottom of the second condenser and out of the top, whence it flows into the bottom of the first condenser and thence to waste. By a careful regulation of the flow of water, which is extremely small, the light creosote oils can be collected from the first vapour box, and the liquor and the crude naphtha can be removed from two cocks at different levels in the washer. We usually divide the oils into those heavier and those lighter than water. The creosote oils when the first vapour box is kept at a temperature of 93° C. tests as follows: Specific gravity, 1·028; water, 3 per cent.; phenols, 9 per cent.; naphthalene, 26·3 per cent.; and is liquid at 30° C.

We have an air-tight settling tank into which the creosote oils are run in normal times, and a considerable amount of the naphthalene salts allowed to crystallize. By this means we can provide a suitable creosote for remixing with the tar for our exhausters or for the market for the preservation of timber. Unfortunately, it is very difficult to find a market in normal times for the naphthalene salts. The naphtha, after two washings and three distillations, yields 45·5 per cent. of benzol, giving 90 per cent. at 120°.

In time of peace, should the price of motor spirit remain at the very high figure it has now reached, I shall rectify sufficient benzol for use on our own motors; but I do not believe that it is wise for any undertaking of less than 1000 millions output per annum to undertake complete tar-distillation. The quantities of the various products are too small to warrant the expenditure; our potential production of benzol being only from 5000 to 7000 gallons per year.

The difficulty of disposing of the solvent naphtha, tar acids, and naphthalene except through a tar distiller, who prefers to do the work himself, is a great obstacle. Gas undertakings will, however, find that in most localities there is a market for creosote and benzol, and most of the remaining products can be returned to the dehydrated tar. If, however, benzol is to become largely used for motors, great care must be taken as to the standardization of the quality sold. Too little attention has been given to this in the past. By doing the final condensation in a rectangular cast-iron tank, the difficulty experienced in working the vapour through a cold cast-iron worm coil condenser, which would be frequently blocking with naphthalene, is avoided.

The outlet bend of the second condenser is never allowed to be stone cold, and no trouble is now experienced. A steam connection is, however, provided, to clear the coil in case of necessity. The result of this condenser blocking is merely to cause a sufficient pressure to blow the seal between the expansion box and the heat interchanger, and to allow vapour and steam to blow out into the finished tar-tank. Directly the stoppage is removed, the tar refils the seal in a minute or two.

The small oxide purifier, though only 4 ft. by 2 ft. by 2 ft., runs for many months without requiring any attention—in fact, if the purifier gets foul it is usually a sign that the condensers are not working properly. The liquor comes off at a strength of 11 oz., and is run through a cooling pipe surrounded by cold water, and thence to the well; while the oils are loaded into steel drums for despatch to our distillers.

TAR TREATMENT FOR TOLUOL EXTRACTION.

After the outbreak of the war, we were impressed with the importance of treating our tar at still higher temperatures, to remove the entire toluol fraction; and as no two tars are probably exactly similar, I give the results of our tests at various temperatures:

Temperature of Still. Deg. C.	Toluol Content. Per Cent.
190	·2
200	·153
210	·025
220	·007 to *nil*
230	*Nil*

To reach a temperature of 200° C. and at the same time to obtain a fair output from the plant, as we had exhausted the preheating capacity of steam we first experimented with a cast-iron preheater placed in the uptake of the furnace, which was fitted with inlet and outlet cocks and bye-pass, and also with arrangements for cleaning out if necessary. This worked satisfactorily for some time, but was superseded by a U pipe leading from the top of the coil and placed in the uptake. This, again, however, though giving us the increase in heat we required, was not quite satisfactory, owing to the great expansion caused by the intense heat of the uptake. We have now dispensed with this, and added four more complete coils at the top of the still—making sixteen coils in all.

There are certain disadvantages when working at 230° C. The tar, when cool, becomes extremely thick; and as our creosote is now wanted by the tar distiller for toluene removal, we cannot thin it out. In fact, unless the tar is removed and used with reasonable speed, in cold weather it will be impossible to get it from the barrels or underground tanks. If the difficulty becomes more acute, it will probably be necessary for us to redistil the creosote out into two fractions, and return the heavier fraction to the tar.

In shutting-down, certain precautions appear to be very necessary. The fire is drawn and the dehydration process continued until the temperature has fallen to 130° C. The object of this is to fill the preheater with tar that can be drained out after cooling. The tar is then prevented from entering the expansion box, and is circulated back to the feed tank until the temperature is reduced to a point at which it is safe to introduce water into the coil to force out the remaining tar. A steam connection is also provided, so that steam can be turned into the coil if required. The heat interchanger is then drained by a cock at the bottom into the finished tar tank; and by this precaution no trouble will be experienced on starting up the plant again.

With regard to repairs, we have been very fortunate; and in this respect the plant is all that can be desired. The amount of crude tar which has been passed through the plant is approximately 1,200,000 gallons; and the repairs, with the exception of those necessary after our small fire (which were covered by insurance), have been practically *nil*. One pump has had an overhaul, and the furnace has been twice patched. Nothing has been done to the coil or any of the joints; but we have broken the top joint occasionally for inspection, and found the interior to be quite clean, with no signs of pitch.

The cast-iron coil still seems to me to have advantages over other types built of mild steel or wrought iron, which must necessarily have a short life. The danger of fire in the Wilton plant appears to be reduced to a minimum. The coil contains only a small quantity of tar; and any leakage which might take place would find its way into the flue, not into the furnace.

I give below the results of some tests made to show the capacity f the plant at different temperatures:

—	230°.	220°.	210°.	200°.	190°.
rude tar used per hour . .	222·8	198·8	192·8	225·6	179·7
ehydrated tar per hour . .	107·0	138·0	120·5	156·9	132·8
ehydrated tar, per cent. .	48·0	69·4	62·6	69·5	73·0
apacity of plant per 24 hours	2568·0	3312·0	2892·0	3765·6	3187·2
rude tar used per 24 hours .	5347·2	4771·2	4627·2	5414·4	4272·8

hese tests are in some respects rather anomalous, as, not being aken on the same day, the qualities of the crude tar treated, and lso probably of the fuel, were not identical.

One disadvantage of working at a high temperature is the difficulty of obtaining a sufficient supply of dehydrated tar to meet ie requirements of one's customers during the hot weather in the ummer, when nearly all our tar is sold for road purposes; and hough we have loyally maintained our temperature, it has been ather trying to feel that on some occasions this has forced our ustomers to go elsewhere to obtain their supplies. On the other and, the value of the heavier fraction extracted is greater than ie value of dehydrated tar; and so it is obvious that it pays to ork at high temperatures. At a working temperature of 220° C. ie financial results are as follows:—

By 556 gallons of refined tar at 2¾d. per gallon . . .	£6	7	5
206 gallons of creosote 62½ gallons of naphtha } at 5¾d. per gallon . . .	6	8	7
67½ gallons of 5° Twaddel liquor		4	1
	£13	0	1
Less working costs:			
884 gallons of crude tar at 2¼d. per gallon	£8	5	9
Labour, 6½ hours		3	0
Coke, 3 cwt. at 1s. 6d. per cwt.		4	6
Interest and depreciation at 7 per cent. on £400, adjusted to gallonage		1	7
	£8	14	10

	£13	0	1
	8	14	10
Net profit	£4	5	3

Or nearly 1·15d. profit per gallon of crude tar treated.

At a working temperature of 200° C. the financial results were follows:

By 580 gallons of refined tar at 2¾d. per gallon. . . .	£6	12	11
185 gallons of creosote 63 gallons of naphtha } at 5¾d. per gallon. . . .	5	18	10
78 gallons of liquor.		4	9
	£12	16	6
Less working costs:			
907 gallons of crude tar at 2¼d. per gallon	£8	10	1
Labour, 6 hours		2	9
Coke 2½ cwt. at 1s. 6d.		3	9
Interest and depreciation at 7 per cent. on £400, adjusted to gallonage		1	8
	£8	18	3

	£12	16	6
	8	18	3
Net profit.	£3	18	3

Or 1·03d. profit per gallon of crude tar treated.

The increase of profit in the year by working at higher temratures amounts to £130.

These are reasonable profits; but, of course, we have been ing the "C" process. This, in our case, though not costing as ich for installation as it has done to many companies, yet has t been done for nothing, as the cooling question during the mmer months was not easily solved.

The working pressure on the plant varies considerably with the ality of the tar treated and the condition of the pump. Our mp is a small horizontal Evans; and we find it a good plan to ow a fair amount slip past the valve, so that the pressure is oderate. With tar of 7 to 15 per cent. water content, our presre is from 15 to 25 lbs. per square inch; but with tar conning 30 per cent. of water it is rather higher. Our pressure uge is fixed to a 4-feet syphon and sealed with cylinder oil. ith this arrangement, no trouble is experienced. The heat efficncy of the plant is from 38 to 40 per cent. The cost of the int was £265, and the building £130.

The demand for the rectified products of coal tar is now very eat; and in the case of some products—toluol and carbolic espelly—increases have taken place since July, 1914. These ineases, however, do not represent nearly so great a percentage the advance in coal prices or in freights; and our gains as an lustry in no way begin to balance our losses. I do not agree th those who say that after the war the demand for the rectified oducts will be good, and the prices high. My own experience es to show that in normal times the distillate produced in my int is sometimes unsaleable, and seldom fetches a price greater an that of dehydrated tar.

Gas undertakings are now being pressed to adopt the "C" pross and tar dehydration. To some of them neither process will profitable. While it is undoubtedly the duty of every undertaking not to spare itself to assist the Government in every way, it is only right that the Government Departments should make it their business to see that no excessive profits are made. At the same time, the carrying out of this patriotic work should in every case be a source of a fair and reasonable profit to the gas undertaking.

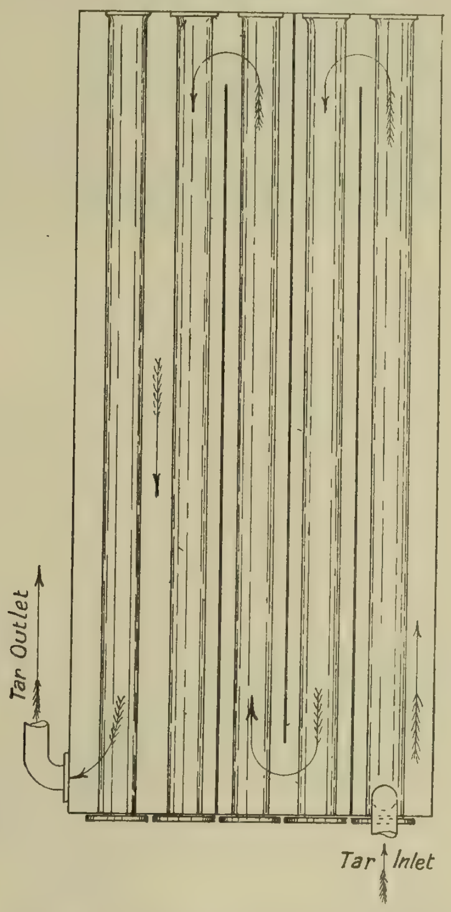
NOTES ON TAR DEHYDRATION.

By R. Wardell, of Tottenham.

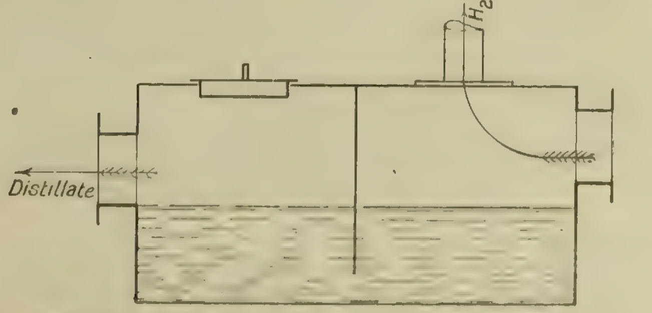
Within recent years the treatment of road-surfaces with dehydrated tar has received a considerable amount of attention, and various types of plant have been designed and manufactured in order to prepare tar for this purpose, one of which is that known as the "Hird" continuous process, as installed at Tottenham. It is to this particular type that I shall confine my few remarks.

Description of the Plant.

The plant proper consists of five vessels—the still A, heat interchanger B, condenser C, and two sight seal-boxes D; and it is capable of dealing with 20 tons of tar per day. In addition to this, there are storage tanks for receiving the distillate and dehydrated tar respectively, together with feed-pump, or overhead tank as the case may be—depending whether the tar is forced into the still, or is allowed to flow by gravity through the plant.



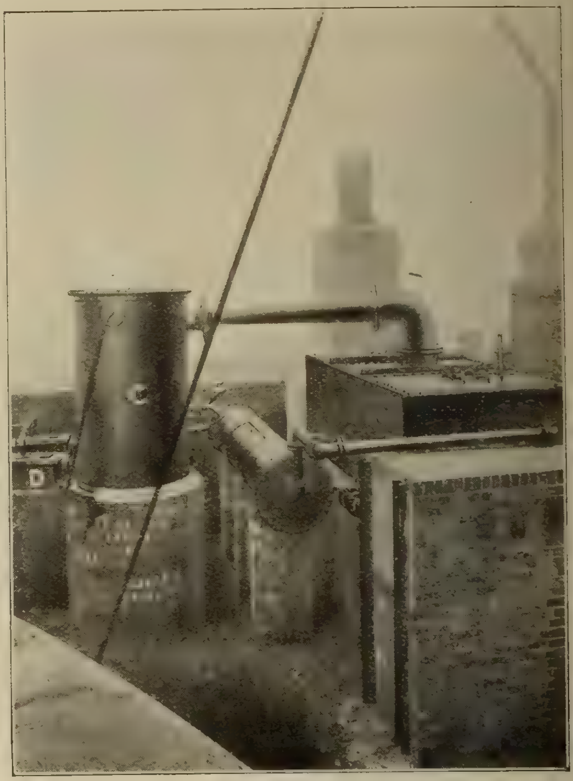
Section of Still, showing Heating Tubes and Baffle-Plates.



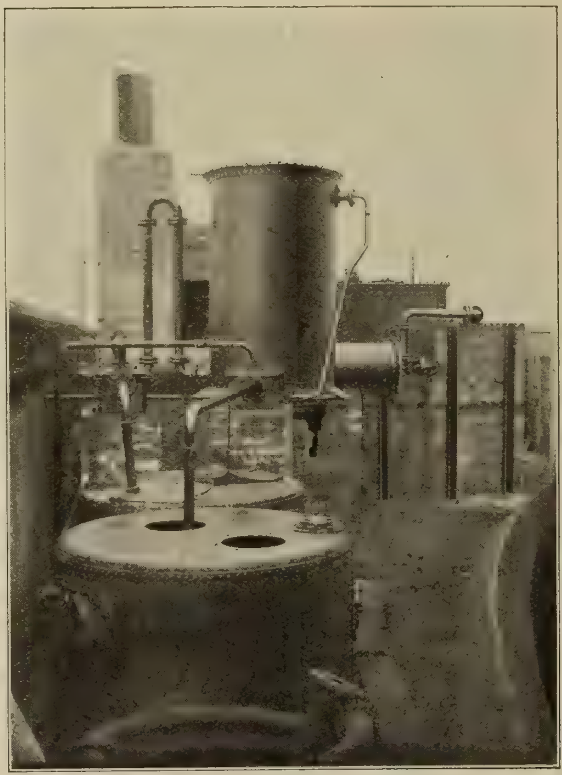
Sight-Box, with Sulphuretted Hydrogen Take-Off Pipe.

The still is built of mild-steel plates, is rectangular in shape, 11 ft. long by 5 ft. wide by 3 ft. 6 in. deep. It is fitted with one horizontal row of five 6-inch steel tubes, running longitudinally and placed about 3 inches from the bottom of the still.

Vertical baffle-plates, 21 inches deep, are fixed between the tubes in such a manner that the tar is made to travel from end to end of the still four times on its way from the inlet to the outlet pipe—a total distance of (approximately) 40 feet.



SOME VIEWS OF THE TOTTENHAM TAR DEHYDRATION PLANT.



The sectional plan shows the tubes and baffle-plates, and arrows denote the travel of the tar.

Two manholes on the top and three handholes on one side are provided for inspection and cleaning-out purposes.

The heat interchanger is composed of two steel tubes placed horizontally, one inside the other. The outer tube is 11 ft. long by 2 ft. diameter, and the inner 11 ft. long by 1 ft. diameter; and they are secured together by two end plates. The crude tar passes through the inner tube in one direction, and the dehydrated tar along the annular space in the opposite direction. A run-off cock at the bottom is used to empty the still when required.

The condenser is 4 ft. diameter by 7 ft. deep, and is fitted with a 3-inch cast-iron coil, through which the vapours from the still pass.

The sight seal-boxes are provided with a mid-feather; and on the top there is a take-off pipe for any sulphuretted hydrogen present; and also a lid through which samples of distillate or prepared tar respectively can be readily taken.

A furnace suitable for burning coke-breeze is placed under the still at one end, and is supplied with forced draught. The furnace gases pass through the heating tubes away to the chimney.

The foregoing is a brief description of the plant. Now, with reference to its working.

Working of the Plant.

The crude tar is, in our case, pumped direct from the wells, slowly and continuously, into the condenser, where it serves as the cooling agent for condensing the vapours from the still, and is itself, at the same time appreciably raised in temperature.

The tar leaves the condenser through an inverted U pipe, and passes into the heat interchanger. Here a considerable amount of heat is imparted to it by the outgoing tar, and it enters the still at about 160° Fahr. It then slowly travels along the four channels formed by the baffle-plates, giving off the light and middle oils on its way to the outlet pipe. Thence it flows into the annular space of the heat interchanger, and then through the overflow-pipe E into the sight-box, and away to the storage tank. The vapours pass along the still head into the condenser, and the condensate flows, by gravity, through the second sight-box into the receiving-tank. The ammoniacal liquor is run off from the bottom of the vessel into the wells. Any sulphuretted hydrogen gas is trapped at the seal-box, and travels along the take-off pipe (shown) to a small oxide purifier.

We have experienced no difficulty in dehydrating either coal gas or carburetted water gas tar; and the flexibility of the plant is probably due to the design of the still, which provides for the heating of a shallow body of tar with an ample vapour space above.

The depth of tar is 15 inches and the vapour space 2 ft. 3 in. This arrangement appears to overcome any tendency to priming, even when working on tar containing a high percentage of water.

Distillation of Carburetted Water-Gas Tar.

During a 15-hour test, 1410 gallons of carburetted water-gas tar were passed through the still and maintained at an average temperature of 296° Fahr. by the consumption of 14 cwt. 1 qr. 21 lbs. of coke-breeze.

Tests of the tar are given below, together with the cost per 24 hours run.

	Crude Tar.	Dehydrated Tar.	Distillate.
Water	31 per cent.	Less than 1 per cent	91 per cent.
Light oils (up to 170° C.)	15 per cent.	7½ per cent.	2½ per cent.
Specific gravity	1·054	1·097	·905

	15 Hours.	24 Hours.	Cost per 24 Hours.
Tar (gallons)	1410	2256	11s. 6d.
Fuel (cwt.)	14·3	23	2 6
Steam, oil, &c.			8 3
Wages			3 10
Interest and depreciation			
			£1 6 1

This cost is equivalent to 0·14d. per gallon, or 2s. 5½d. per ton of tar treated.

It will be seen that with tar containing a high percentage of water, more than 2200 gallons of it can be effectually treated per

24 hours in this size of plant. The higher the water content of the tar, the slower must be the travel of the tar through the still n order to obtain thorough dehydration.

Tests of Coal-Gas Tar.

With a still temperature of 400° Fahr., all the light oils, and most of the phenols, are driven off. But it is necessary to work at 500° Fahr. in order to liberate the whole of the crystallizable phenols, and so comply with the requirements of the No. 2 Specification of the Roads Board authorities.

At 400° Fahr. the distillate tests gave the following results:

Specific gravity ·950.
100 c.c. fractionated 5 per cent. at 100° C.
17 per cent. at 120° C.
Tar acids, phenols 11 per cent.
Prepared tar was entirely free of water.

At 500° Fahr. the distillation test of the prepared tar was as follows:

Up to 140° C., no water.
do. 140° to 220° C., 2·6 per cent. distillate.
140° to 300° C., 22 per cent. do.
Prepared tar: Specific gravity, 1·21.
Distillate: Specific gravity, ·995.
100 c.c. fractionated 23 per cent. at 200° C. benzol, toluol, and solvent naphtha.
Tar acids and phenols, 18 per cent.
Pyridine bases and pyridine, 3 per cent.

Fuel tests were not taken; but in view of the fact that carburetted water-gas tar containing 31 per cent. of water can be dehydrated for 0·14d. per gallon, crude coal-gas tar containing say) 5 to 10 per cent. of water ought to be prepared at a cost of not more than $\frac{1}{10}$d. to $\frac{1}{8}$d. per gallon.

When working at 500° Fahr., we were troubled at first with the deposition of naphthalene in the distillate pipe beyond the sight-box. But this difficulty was overcome by inserting a steam-pipe n the distillate pipe, and keeping the condensate hot, in order hat all the naphthalene should be carried forward into the receiving-tank.

The condenser is connected in the opposite way to that usually followed in gas-works practice; the object being to keep the distillate warm and prevent naphthalene stoppages.

An appreciable saving in fuel was effected by raising the brickwork to the top of the still along both sides, and packing the cavity between the brickwork and the still with slag wool.

With the present heavy demand for toluol and benzol—a demand that is likely to continue after the close of the war—a plant of this type, which can prepare the crude fractions, will, I think, prove a useful addition to many of the large and medium-size gas-works, the installation of which will lead in not a few cases to he erection of a complete tar-distillation plant.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

Visit to the Greenock Gas-Works.

On Saturday, the members of the Scottish Junior Gas Association to about the number of sixty visited the Greenock Corporation Gas-Works at Inchgreen. Under ideal weather conditions the party spent a most interesting and enjoyable afternoon going over he installation of Woodall-Duckham vertical retorts, the liquid ammonia plant, and in viewing the new million cubic feet capacity gasholder in course of erection. Great interest was shown in the mechanical handling of the coal, from the tipping of the truck to the means adopted of tripping the conveyor buckets and so discharging the coal at any desired place. The power throughout is obtained from electric motors; the electricity being generated in he works. A very fine chemical laboratory and coal-testing plant add to the completeness of the works.

From the works the party went to the new show-rooms, where a goodly selection of gas fires, cookers, hot-water circulators, boilers, and furnaces are exhibited to the best advantage in a roomy and well-lit show-room. A set of model apartments (kitchen, dining-room, bedroom, and bathroom) are fitted up to show what can be done by gas. The whole display leaves little to be desired or criticized.

The party were afterwards entertained to tea in a hall which is set apart for demonstration purposes, and in which free cookery demonstrations are given periodically.

In welcoming the party, the Convener of the Gas Committee said that if anyone present had seen the gas-works six years ago, he would realize what a tremendous amount of work Mr. MacLeod had accomplished since he came to Greenock. Practically everything on the works was new; and while some things might be open to criticism, he thought they had done fairly well. They had to build the new plant practically on the site of the old works; and they therefore had not the same freedom of action in designing the works as they would have had if the old ones had not been there. In putting up their new plant, they had erected what they considered ample to cope with any increased consumption that might be anticipated. The plant itself had more than justified their expectation. But the increase in gas consumption had exceeded their anticipation; and he thought the time was not far distant when additional plant would require to be installed. This, of course, had been provided for, as space for new retorts had been left alongside the present ones. He would be pleased to hear any criticism members of the party would like to offer, as they at Greenock were not above taking a hint. He hoped that at some future date he would again have the pleasure of welcoming the Association to Greenock.

The President (Mr. David Fulton), in reply, said the Association were greatly indebted to the Greenock Corporation for their kindness in allowing the members to visit the works; the educational value of such visits being invaluable to all of them.

Mr. MacLeod said that, in setting about the new work, he had followed the Scottish trait of extreme caution; and he advised the members, if they ever had similar work to undertake, to err on the side of over-cautiousness, and not to promise even as much as they themselves expected. The new works at Greenock cost a large amount of money; but still the Greenock gas undertaking was relatively the lowest capitalized concern in the country; and he would like to impress upon his hearers the necessity of keeping-down capital expenditure. It was quite unfair to say that one undertaking had not done so well as another until full consideration had been given to the conditions under which each undertaking worked; and capital expenditure had more to do with the apparent difference than working. He congratulated the Council of the Association on the three visits arranged for the present session—viz., Greenock with its installation of Woodall-Duckham verticals; Johnstone, with its Wilson verticals; and Kilmarnock, with its Dempster verticals.

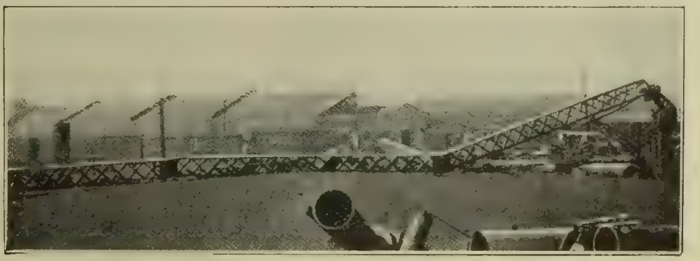
Mr. John Frazer (Dalmarnock Gas-Works) moved a vote of thanks to the Chairman.

Mr. McGhee (Glasgow) thought that Greenock had nothing to learn as far as show-rooms were concerned either from the Second City of the Empire or from some of the North of England towns whose show-rooms had been so much talked about, and which he had had the pleasure of visiting a few months ago. He was very pleased to see the semi-indirect system of lighting adopted; and he recommended it as the ideal.

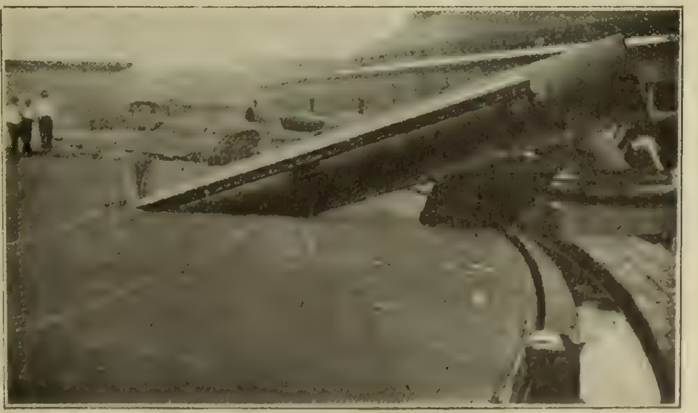
A STORM WRECKED GASHOLDER.

Gas Plant Damaged by a Gale at New Orleans.

According to "Gas Record"—a Buffalo publication—a very severe storm which visited New Orleans on Sept. 28 did execution around the gas plant, as shown by the accompanying reproductions of photographs. The wind, it is said, reached a velocity of 120 miles an hour, and damaged practically every roof in New Orleans. It also demolished an old gasholder (No. 6) having two lifts and an underground tank of 500,000 cubic feet capacity. This was built in 1874 and partially rebuilt in 1909—a new curb, crown, and cups being installed. The holder contained gas at the time it was wrecked; but heavy rain prevented a fire. The 5 million cubic feet holder recently built by Messrs. Wood and Co. was full at the time; its five lifts extending about 250 feet in the air. This stood the wind without any apparent damage, as did the 1 million cubic feet holder by its side. The hurricane sweeping through the narrow space between the holders found the gateway of the plant in its path, and the men coming to work upon entering were literally blown into the yard.



Superstructure of the New Orleans Gasholder Blown down by the Storm.



A Cast-Iron Column Punctures the Crown of the New Orleans Gasholder.

THE DEPENDENCE OF THE LIGHT OF THE HEFNER LAMP ON ATMOSPHERIC CONDITIONS, MORE ESPECIALLY ATMOSPHERIC PRESSURE.

FROM THE LABORATORY OF THE SCHLIEREN WORKS OF THE ZÜRICH GAS UNDERTAKING.

By Dr. E. Ott, Member of the former International Photometric Commission.

[English translation by Mr. W. J. A. Butterfield, M.A., &c.]

Professor Dr. E. Liebenthal, Member of the Imperial Physical Technical Institute (Reichsanstalt) at Charlottenburg, proposed the following formula for the illuminating power y of the Hefner lamp—viz.:

$$y = 1{\cdot}049 - 0{\cdot}0055x - 0{\cdot}0072\,(x' - 0{\cdot}75) + 0{\cdot}00011\,(b - 760),$$

in which:

x = the volume, expressed in litres, which the aqueous vapour associated with 1 cubic metre of dry air free from carbon dioxide would have at the same temperature and same pressure;
x' = the carbon dioxide contained in the air expressed in the same manner; and
b = atmospheric pressure within the range 735 to 775 mm. of mercury.

On the other hand, W. J. A. Butterfield, F.I.C., J. S. Haldane, M.D., F.R.S., and A. P. Trotter, M.Inst.C.E., found the formula:

$$I' = \frac{100 - \left(\frac{a - A}{0{\cdot}16} + \frac{c - C}{0{\cdot}035} - \frac{p - P}{12{\cdot}5}\right)}{100}\,I$$

in which:—

I' = the varying light of the Hefner lamp expressed in terms of its light I in normal conditions;
a = the varying percentage by volume of aqueous vapour in the air;
A = the normal percentage of aqueous vapour in the air;
c = the varying percentage by volume of carbon dioxide in the air;
C = the normal percentage of carbon dioxide in the air;
p = the varying atmospheric pressure in mm. of mercury;
P = the normal atmospheric pressure at sea level.

$y = 1$, and $I' = I$ (1 Hefner unit, HK) when the Hefner lamp is burning in normal conditions—*i.e.*, with an atmospheric humidity of 8·8 litres of aqueous vapour; carbon dioxide amounting to 0·75 litre per cubic metre of pure air,* and an atmospheric pressure of 760 mm.

[* "Pure air" in the sequel always signifies dry air free from carbon dioxide.]

Mr. Butterfield communicated the results obtained in England to the International Photometric Commission at its third congress at Zürich in the year 1911. As the English formula contains a correction for the effect of carbon dioxide on the light of the Hefner lamp three times as great, and for the effect of ordinary fluctuations of atmospheric pressure a correction four times as great, as the German formula, the Commission expressed a desire that the researches should be repeated. The President (Professor Vautier) having suggested that this should be done at very different altitudes, in order primarily to ascertain the effect of atmospheric pressure, Director A. Weiss, of Zürich (who, unfortunately, has since died), and Hofrat L. Kusminsky, of Vienna, expressed themselves willing to undertake the task.

Owing to various circumstances, our laboratory could not put in hand this special work until the spring of 1914, after a lot of prolonged preparatory work had been carried out. The measurements were made by means of a portable equipment, which is described below, at the Jungfrau Joch station of the Jungfrau Railway (3450 metres = 11,319 feet above sea level, and with a barometer reading of about 500 mm. of mercury); at the Wengen Alp Railway Stations, Kleine Scheidegg (2067 metres = 6781 feet above the sea level, and 590 mm. barometer), and Lauterbrunnen (800 metres = 2625 feet above the sea level, and 695 mm. barometer); and in the potash mine "Alex," near Bollweiler, in Alsace (400 metres = 1312 feet below the sea level, and nearly 800 mm. barometer). A more favourable choice of experimental stations with more regular barometric differences could scarcely have been chosen; and the gas-works laboratory at Schlieren (about 400 metres = 1312 feet above sea level, and 727 mm. barometer) was in a suitable position to afford an intermediate controlling figure.

Unfortunately, however, these very laborious and tedious measurements showed an improbable course of variation in the light with the differences of height, which was, however, quite readily attributable to the distance in place and time between the experiments. The work had to be carried out in air of very different composition, often (on account of the small size of the room placed at our disposal) in particularly vitiated air, the effect of which on the measurements cannot be determined with sufficient certainty. The results were also liable to be affected unfavourably by the very different temperatures of the rooms, by the fact that the Hefner lamp frequently burnt in an unsettled manner, and by the repeated setting up, taking down, and transporting of the apparatus. To sum up, the results of the experiments undoubtedly demanded confirmation by an investigation made at one and the same spot, instead of in different places, in order that the determinations at varying atmospheric pressures should be carried out with air of the same quality as far as possible, and with no change being made in the apparatus in the course of a series of tests.

The recognition of this led, naturally, to the employment of a compression chamber. This consisted of a new iron vessel which had been ordered for other purposes, and in which the desired repetition of the measurements was carried out between Jan. 20 and Jan. 31, 1915. In contradistinction to earlier work, however, these investigations were made at only three different pressures—viz., at atmospheric pressure and at 100 mm. of mercury above, and 100 mm. of mercury below, atmospheric pressure—since this appeared to be sufficient to cover practical conditions, while the consequent curtailment of the experiments was an advantage from the standpoint of accuracy. The vessel also was thus not subjected to too great a pressure.

The compression vessel had a length of 6·20 metres (20·3 feet) and a diameter of 1·80 metres (5·9 feet). For practical reasons it was used in the upright position. It was provided with a manhole, and three tubulures for the air and electricity supplies, as shown in the accompanying drawing, which also shows the arrangement of the air-pump, the air-chests, and the connections. By suitable setting of the cocks, either a reduced or an increased pressure, or atmospheric pressure, could be maintained by the pumps and measured on a water-gauge. The pressures were quite readily maintained constant without any special regulator by throttling one or other of the cocks. The air was always passed in from the bottom to the top of the chamber, as in this way rapid removal of the vitiated air could be most easily and completely effected without eddies. The removal in this manner is facilitated by the natural upward movement of the air warmed by the observer and the flame. The air particles were given a parallel course through the compression vessel by the perforated plank flooring and the perforated plank ceiling, and consequently with an adequate supply of air the flame burned with normal quietness.

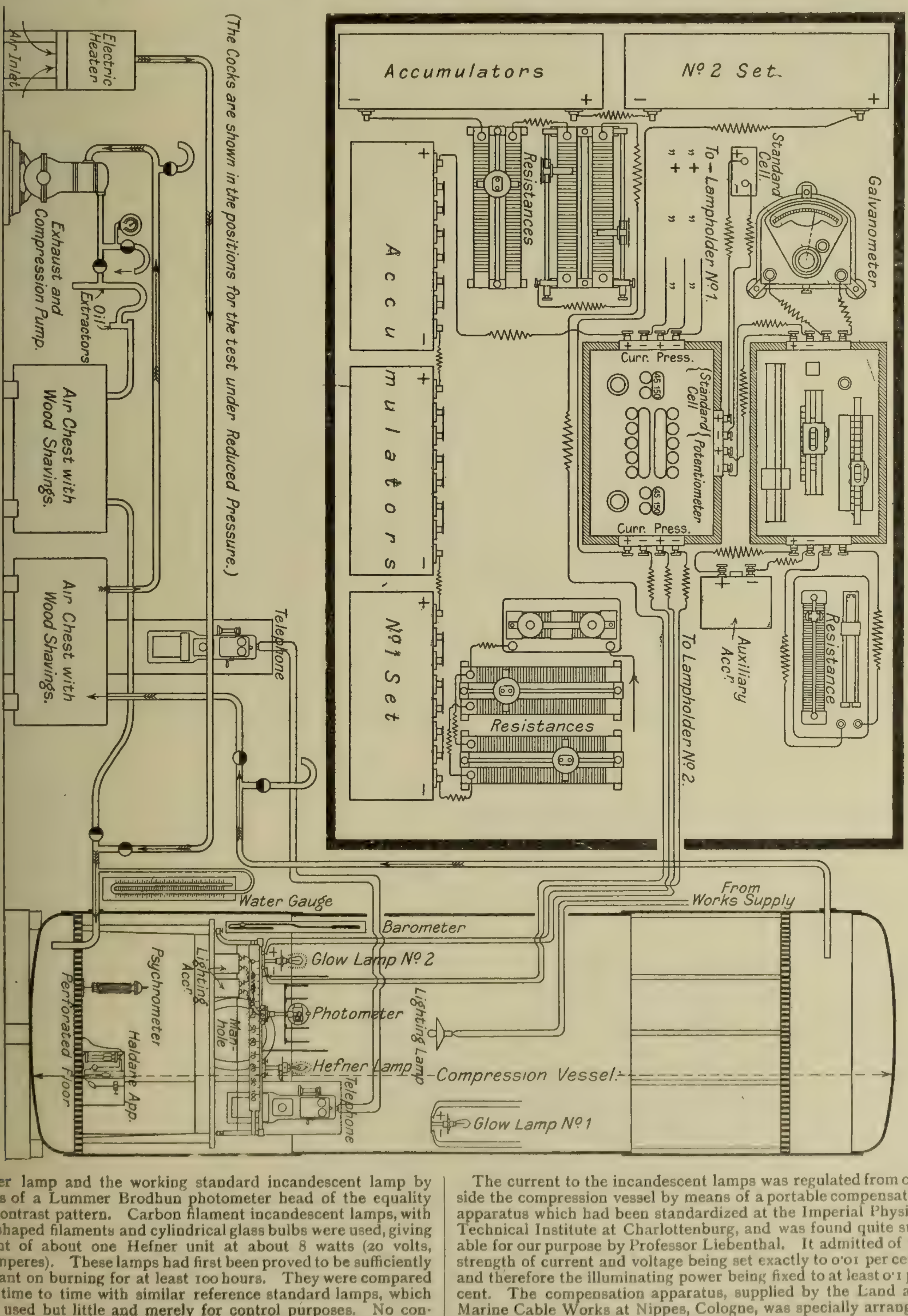
The position of the cocks shown in the drawing represents the method of working at a reduced pressure. In this case, in order to compensate for the cooling resulting from expansion, the air was warmed in the electric oven; so that the whole series of experiments could be carried out with fresh air at temperatures between 20° to 23° C. (68° to 73° Fahr.).

The pumps were also kept going during the experiments with pure air at atmospheric pressure. Thus the air was practically identical at increased and atmospheric pressure, and little altered in composition at reduced pressure. The contaminated air required for determining the effect of carbon dioxide and aqueous vapour was obtained by stopping the pump and allowing the products of breathing and combustion to accumulate, and by sprinkling hot water or spreading out dry calcium chloride. The maximum temperature thus attained was 24° C. (75° Fahr.). It must, however, be pointed out in this connection that an effect on the flame varying in degree took place according to the source of the vitiating constituents—viz., carbon dioxide and aqueous vapour—because the light is affected specially by the relative proportion of oxygen—*i.e.*, the ratio of oxygen to nitrogen. The more carbon dioxide and aqueous vapour arise through combustion (and not by mere admixture), the more oxygen disappears relatively to the nitrogen, and the more considerable is the loss of light.

Carbon dioxide, moreover, has considerably greater effect than aqueous vapour. This was proved by Bunte and Burschell twenty-five years ago [*vide* "Journal für Gasbeleuchtung," 1891, p. 310, *et seq.*], further reference to whose very interesting experiments will be made later.

The whole apparatus was installed in very favourable temperature conditions in the first condenser room of the No. 2 apparatus house of the gas-works. Pure outer air was always supplied to the pump.

A small table, which was fastened to the plank floor of the iron vessel, carried a short photometer bench, for comparing the Hefner lamp and the working standard incandescent lamp by means of a Lummer Brodhun photometer head of the equality and contrast pattern. Carbon filament incandescent lamps, with bow-shaped filaments and cylindrical glass bulbs were used, giving a light of about one Hefner unit at about 8 watts (20 volts, 0·4 amperes). These lamps had first been proved to be sufficiently constant on burning for at least 100 hours. They were compared from time to time with similar reference standard lamps, which were used but little and merely for control purposes. No considerable change of illuminating power was at any time observed, which tallies entirely with experience of them gained otherwise.



(The Cocks are shown in the positions for the test under Reduced Pressure.)

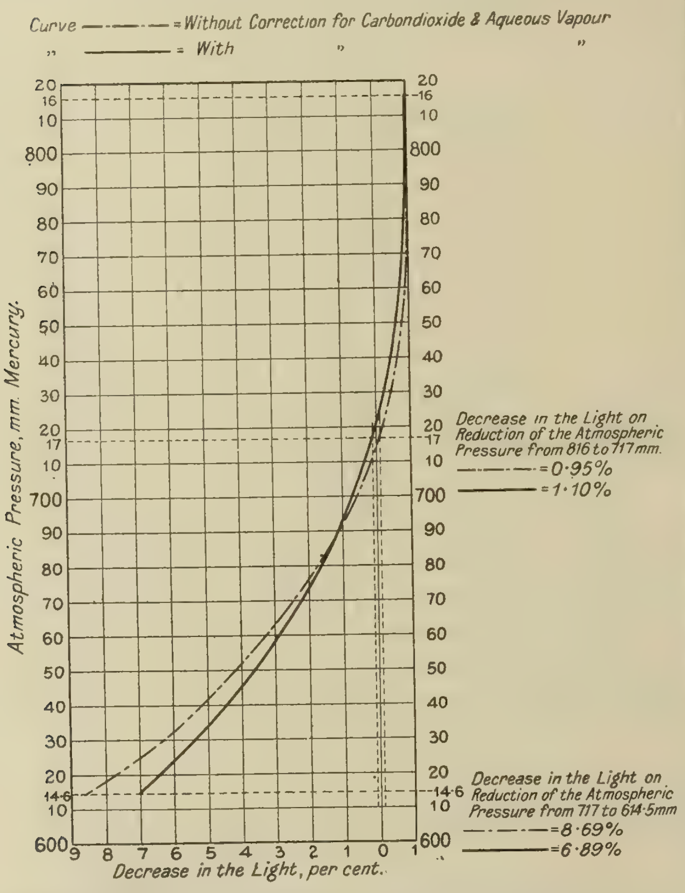
ARRANGEMENT EMPLOYED IN DETERMINING THE LIGHT OF THE HEFNER LAMP IN DIFFERENT ATMOSPHERIC CONDITIONS.

The tests were made with two incandescent lamps; but one and the same lamp was used throughout a complete series of tests at the three different pressures without being disconnected, in order to avoid disturbing the state of equilibrium of the apparatus. Any discrepancies between the readings of the scale on the photometer bench and the true distances between the incandescent filaments, photometer, and Hefner lamp, were neutralized by arranging that the photometer settings always fell about the middle of the distance of 80 cm. between the two sources of light; and as the latter also had nearly the same colour, the errors of measurement were reduced to a minimum.

The current to the incandescent lamps was regulated from outside the compression vessel by means of a portable compensation apparatus which had been standardized at the Imperial Physical Technical Institute at Charlottenburg, and was found quite suitable for our purpose by Professor Liebenthal. It admitted of the strength of current and voltage being set exactly to 0·01 per cent., and therefore the illuminating power being fixed to at least 0·1 per cent. The compensation apparatus, supplied by the Land and Marine Cable Works at Nippes, Cologne, was specially arranged so that, by means of a positive switch, two lamps—viz., the one used in testing and the "reference standard"—could be controlled with the required accuracy. A Weston cell, saturated at 4° C., and practically independent of temperature, was used as the standard cell. The rest of the arrangement can be followed from the drawing on p. 379.

The composition of the air was determined by physical volumetric methods as follows: The proportion of aqueous vapour was ascertained by the Assmann aspiration hygrometer [as recommended in Liebenthal's "Praktischer Photometrie," p. 117], and the proportion of carbon dioxide with the apparatus of J. S. Haldane, as recommended by Butterfield and described, *inter alia*, in the "Journal of Gas Lighting," Vol. CVI., p. 373. Both gave values in agreement with gravimetric methods. The latter, therefore, could be wholly dispensed with, which was especially advantageous, as they are not well adapted for work in conjunction with experiments which have to be carried through quickly, with rapid changes of pressure. Moreover, they would not have given results for a particular moment, as was absolutely necessary for tests beginning at any time. The use of the two methods together would have been much too troublesome and tedious. In order to obtain average values which should be as correct as possible, the following order of working was always observed: Reading the syphon barometer, determination of the carbon dioxide, determination of the humidity, reading the photometer, determination of the humidity, determination of the carbon dioxide, reading the barometer.

The equipment inside the vessel, which was coated dead-black, comprised, in addition to the barometer already referred to, a series of screens, a telephone for intercourse with the exterior, and an incandescent lamp with convenient switch for lighting.



Decrease Observed in the Light of the Hefner Lamp on Reduction of the Atmospheric Pressure from 816 to 614·5 mm. of Mercury.

The readings of the photometer were made by the writer of this report personally, at such times as were indicated, by two other observers, who were keeping continuous control of the height of the Hefner flame (which was fed with amyl-acetate complying with the prescription) and of the intensity of the current and voltage of the incandescent lamp. A special device was found unnecessary for mixing the air in the vessel, on account of it being so narrow and the fresh air being in flow through it. Hence nothing more was necessary in the trials made with fresh air to ensure a sufficient admixture. When, however, the pump was stopped, the vitiated air produced was stirred with dusters; while the determinations of carbon dioxide and humidity were always made in the immediate neighbourhood of the flame, but screened from its radiation.

In order to render the solution of the particular question—viz., the determination of the effect of changes of atmospheric pressure on the light of the Hefner lamp—independent of disturbing factors—a transition was first made from atmospheric pressure (717 mm. on the average), through a pressure increased by about 100 mm. of mercury, to a pressure reduced by about 100 mm.; then from the increased pressure through atmospheric pressure to the reduced pressure; and finally beginning with the reduced pressure. In conclusion, an investigation was made with vitiated air under atmospheric pressure in order to determine the effect of carbon dioxide and aqueous vapour.

The results are summarized in the sequel:

1.—Effect of Atmospheric Pressure.

(*a*) 816 to 717 mm. of mercury.

On changing the atmospheric pressure from 816 to 717 mm. of mercury with practically unaltered composition of the air—at the high pressure the air contained on the average 10·47 litres of aqueous vapour and 1·27 litres of carbon dioxide, and at atmospheric pressure 10·66 and 1·19 litres respectively per cubic metre of pure air—the sources of light being at the distance of 80 centimetres already mentioned, the photometer had not to be moved approximately 4 mm., which would have corresponded with the change of light of 4 per cent. ascertained in England, but on the average only by 0·95 mm., which corresponds with a decrease of light of 0·95 per cent. Taking into account the effect of carbon dioxide and aqueous vapour, according to the formula given below, the decrease rises to 1·10 per cent., which difference is, however, so small that it falls within the limits of experimental error.

It can therefore be stated with certainty that the decrease of light of the Hefner lamp through a diminution of atmospheric pressure of 99 mm. of mercury in the interval from 816 to 717 mm., which is the most important range from the practical standpoint, amounts to only 1·1 per cent., and that therefore the portion of Liebenthal's formula relating to atmospheric pressure corresponds with the fact.

Any other result was hardly to be expected, as the member of the formula in question had been obtained by the method of least squares from a sufficient number of observations made in a well-ventilated large room.

(*b*) 717 to 614·5 mm. of mercury.

At the change of pressure and an average of 12·65 litres of aqueous vapour and 1·34 litres of carbon dioxide in the attenuated air (the composition of the air at the atmospheric pressure of 717 mm. being as already stated above), the photometer had on the average to be moved 9·05 mm. towards the Hefner lamp, which corresponds with a decrease of light of 8·69 per cent. without correction, and of 6·89 per cent. with correction for carbon dioxide and aqueous vapour according to the formula given later.

This decrease is thus considerably greater than that found by Liebenthal in the pneumatic chamber. The difference is readily explicable by the fact that Liebenthal, according to his own account, did not secure quite satisfactory measurements because he was using a Weber photometer with a benzine standard.

It is of interest that the average decrease of light thus found over the whole interval from 816 to 614·5 mm. pressure is equal to that found by Butterfield, Haldane, and Trotter—viz., about 4 per cent. per 100 mm. decrease of pressure. But our points lie on a curve, and those of the other observers on a straight line. It may be mentioned that, further, two mean points at 763 and 663 mm. pressure fit in the curve referred to above. These measurements were obtained from the tests made in the spring of 1914.

2.—Effect of Carbon Dioxide and Aqueous Vapour.

As already explained, this effect depends not merely on the constituents themselves which cause the vitiation, but also on their origin. It could not therefore be determined so unequivocally as could the effect of atmospheric pressure. Experiments by Bunte and Burschell with the batswing burner, the argand burner, and the Hefner lamp, showed, in general, about the same effect from admixed carbon dioxide and admixed aqueous vapour as Liebenthal found; while these impurities, when occurring as products of combustion, lowered the illuminating power to a relatively much greater extent. Thus the carbon dioxide lowered it in a ratio which falls between that found by the Englishmen and that found by us.

Since an increase of carbon dioxide and aqueous vapour generally is accompanied by a diminution of oxygen, special experiments with mere admixture of carbon dioxide, as carried out by Liebenthal, do not represent what actually takes place. On the other hand, admixture of aqueous vapour, though of smaller effect, takes account of the change of natural atmospheric humidity. In any case in a formula applicable to the effect of vitiation of the air of a room the effect of the products of combustion and breathing must not be disregarded. Since, however, the ratio of the quantities of the impurities which thus come into account constantly varies, it is impossible at the outset to give a formula which will be correct for all experimental conditions. The formula expressed below therefore, strictly speaking, only applies to air of similar composition to that in our experiments; and therefore the changes of the light with variations in the atmospheric pressure have been stated above with and without correction for the vitiation of the air.

Our investigations have been mostly made at atmospheric pressure and with the aqueous vapour ranging from 9·93 to 21·19 litres and the carbon dioxide from 1·00 to 3·90 litres per cubic metre of pure air. For our experimental conditions the change of light per litre of aqueous vapour was 0·62 per cent. and per litre of carbon dioxide 3·30 per cent. Liebenthal found 0·55 and 0·72 per cent.; Butterfield, Haldane, and Trotter, 0·625 and 2·20 per cent.; and n investigation made by Paterson, at the National Physical aboratory at Teddington, on the effect of aqueous vapour, gave he result of 0·60 per cent. These differences, which are inconiderable for aqueous vapour, are appreciable for carbon dioxide. hey arise clearly from the fact that Liebenthal worked in a arge room which was always well-ventilated, and determined the ffect of carbon dioxide only by admixture of carbon dioxide from cylinder; whereas the other observers carried out their investiations in small rooms with air contaminated by the products f breathing and combustion, and therefore relatively poorer in xygen. It may be of interest to point out that the factor for the ffect of carbon dioxide given by our formula is smaller than that f Butterfield, Haldane, and Trotter, but in any given case may e compensated by the larger factor for the effect of atmospheric ressure. This probably accounts for the difference in the factors or atmospheric pressure.

From the foregoing it undoubtedly follows that the factor relating to carbon dioxide of Liebenthal's formula is considerably too small, as in practice it is not generally a case of admixed carbon dioxide, but of carbon dioxide from breathing and combustion, if work is being carried on in badly ventilated rooms.

The formula based on our researches is as follows:

$$y = 1{\cdot}049 - 0{\cdot}0062x - 0{\cdot}033\,(x' - 0{\cdot}75) + 0{\cdot}00011\,(b - 760)$$

n which the symbols have the significance already stated at the eginning of the report, only that b in this applies to the greater ange of difference of pressure (816 to 717 mm. of mercury).

In this connection it must, however, be expressly pointed out hat a different ratio of oxygen to nitrogen would also involve a ore or less extensive alteration of the factors for aqueous vapour nd carbon dioxide. The two members of the formula in question learly can only be regarded as indicative, especially as the effect f these impurities is probably also to some extent dependent on he atmospheric pressure. For a final settlement of these factors much longer series of investigations would still be required, as xact measurements with the Hefner lamp in themselves involve ery ticklish work, which induces us, even in this connection, to xpress the hope that a steadier and more readily managed unit of ight will soon be found.

The matter is different when the ratio of oxygen to nitrogen reains about the same, as is the case in working in well-ventilated nd sufficiently large photometer rooms. Liebenthal's factors for tmospheric humidity and pressure apply specially to this case; nd as they emanated from a sufficient number of observations, nd moreover show good or very good agreement with our values, hey may be accepted as correct. The factor for carbon dioxide ust, however, drop out, and the measurements then apply to he average proportion of carbon dioxide of 0·75 litre per cubic etre of pure air given by Liebenthal for well-ventilated rooms.

In order therefore that work may be always carried on in uniform and well-defined conditions, and the light of the Hefner lamp be subject to proper corrections, photometer tests with it must always be made only in well-ventilated and sufficiently large rooms. The light is then only dependent on the natural humidity of the outer air and the atmospheric pressure, and may without objection be calculated according to the following abbreviated Liebenthal formula:

$$v = 1{\cdot}049 - 0{\cdot}0055x + 0{\cdot}00011\,(b - 760).$$

n this formula the symbols have the meanings given above, ith b ranging from 816 to 717.

In conclusion, all who, directly or indirectly, participated in hese researches are heartily thanked for their co-operation. It as only possible to carry through the work owing to the great nterest which the former and present Managers of the Zürich as-Works—viz., the late Herr A. Weiss and Herr F. Escher—ok in them throughout. Through them quite adequate grants r the work were without difficulty obtained from the authorities, epresented in this matter by Councillors Fritschi and Kern. reat interest was shown also by the sending by Geheimrat rofessor H. Bunte of Dr. K. Bunte and Dr. Hofsass to assist the measurements at different altitudes. Further, mention ust be made of Herr E. Fridori, Chemist by diploma, and erren W. Grimm and H. Ringli, Engineers by diploma, as well s the laboratory assistant, Herr Ch. Schellenbaum. Finally, the pecially valuable assistance of Herr Liechti, the Manager of the ungfrau Railway, in arranging for setting up the photometer ooms and conveying the instruments must be mentioned, as also he granting of access to the Alex Mine, near Bollweiler, by Herr os. Vogt, the Manager, with the consent of Herr A. Schmidt, the anager at Mulhouse, in Alsace.

Gas Industry of Japan.—In 1900 there were only two gas comanies in Japan; but by 1913 this number had been increased to 5; the quantity of coal carbonized rising in the same period from 4,323 tons to 476,481 tons a year. In the latter year there were ver 1000 miles of mains; while the lighting consumers were 43 imes as numerous as in 1900, and consumers of gas for heating howed a much greater proportionate growth. At the same time, he percentage of profit on the paid-up capital employed in the dustry shows a decrease from 19·7 per cent. in 1901 to 11·2 per ent. in 1913.

COKE-OVEN GAS FOR LEEDS.

To the traveller entering the City of Leeds by railway from the South at night time, two features have usually both attracted attention and denoted passing within the city boundaries. The first of these is the brilliant light, bathing the whole surroundings in its warmth and glow, which radiates from the huge cupolas of the Leeds steel-works. The second is the reflection—intrinsically far feebler, and dwarfed by comparison with the brilliance of the steel-works—of the flaring flames, looking like huge torches in the darkness, of the waste gas from the coke-ovens belonging to the Middleton Estate and Colliery Company.

In future the traveller will look in vain for the second of these reflections. Arrangements made some months ago for the purchase of the gas by the City of Leeds Gas Committee have now been carried into effect; and, instead of being burnt uselessly at the coke-oven vents, some million or so cubic feet of the gas will daily be passed through the plant of the Dewsbury Road Gas-Works, and thence on to be utilized by the gas consumers within the city limits.

For the transmission of the gas some 2¼ miles of 9-inch steel main, of No. 4 I.W.G. with long-sleeve welded joints, has been laid from Dewsbury Road to the coke-oven plant at the Middleton Colliery. As a portion of this main traverses areas which have been undermined by the colliery operations, and where, therefore, subsidence may be expected, lead jointed Kimberley collars have been inserted at suitable points in the length of main; and these have been enclosed within observation chambers so as to facilitate periodical inspection. The provision of high-pressure valves at approximately each successive length of 500 yards, renders it easy to carry out any repairs which may from time to time be necessary, without exhausting the whole length of main.

We understand that the Middleton Colliery Company are under agreement to deliver the coke-oven gas to the Dewsbury Road Gas-Works at a minimum pressure of 8 inches of water. This has necessitated putting down compressors at the Middleton end. The compressors installed are of the well-known rotary type of the Bryan Donkin Company, of Chesterfield, are steam driven, and (of course) in duplicate. Each compressor is capable of dealing with 50,000 cubic feet of gas per hour against a pressure of 54 inches head of water.

At the Dewsbury road end of the main, a blow-off pot, with a seal equal to 16 inches head of water, has been inserted; so that if, from any cause, pressures should build-up in the main, relief may be afforded before the gas enters the gas-works plant. To prevent the reverse of this occurring—namely, a passing of gas from the gas-works to the colliery, in the event of the compressors from any cause being thrown unexpectedly out of action—a flap-valve, suitably weighted, comes into operation on the gas-works, which automatically shuts off the main when the pressure falls below a certain minimum. After passing the blow-off pot and the flap-valve, the crude gas is measured by a station meter before being taken through the works exhausters.

As the quantity mentioned above—namely, one million cubic feet per day—is only equal to about one-fifteenth of the maximum daily output of the undertaking, there can, of course, be no question of undue reliance upon this source of supply. In certain eventualities, the danger of such reliance on the part of an undertaking with great public responsibilities needs no emphasizing. But, on the other hand, given a suitable price and quality, the value of such an auxiliary supply in the case of a large gas department is sufficiently obvious. Especially is this the case where, as in Leeds, portions of the manufacturing plant are undergoing reconstruction and rearrangement.

In order to avoid the inconvenience and dislocation which would probably ensue if there were wide irregularities in the quantities of gas sent forward, the stipulation has been made that the gas shall be supplied in regular hourly quantities, and of uniform quality. Recording calorimeters have been installed side by side on the gas-works for both the coke-oven gas and the mixed gases, so that the quality of the supply may be under continuous observation.

We are not at present at liberty to publish definite information as to price and quality in this particular case of Leeds. But we may so far lift the veil as to say that both minimum candle power and calorific value, and maximum nitrogen content, have been carefully specified in the agreement. Furthermore, a sliding-scale of prices, according to calorific value, has been arranged covering qualities between 400 and 600 B.Th.U.; and we believe that this has been so fixed as to give the Colliery Company a financial interest in maintaining a high calorific value.

The supply of the coke-oven gas has been proceeding for nearly a month now; and we understand from the Engineer and Manager (Mr. W. B. Leech) that so far the supply has been entirely satisfactory.

On the occasion of the first ordinary meeting this session of the Royal Society of Arts, to-morrow (Wednesday) afternoon, the silver medals awarded by the Council of the Society will be distributed. Among the recipients will be Mr. H. M. Thornton, J.P., M.I.Mech.E., who will receive a silver medal for his paper on the "Uses of Coal Gas for Industrial Purposes," read before the Society last March—see "Journal," Vol. CXXIX., p. 743.

GAS-FIRE DEVELOPMENT 1913-15.

By Harold Hartley, M.Sc., Chief Chemist to the Richmond Gas Stove and Meter Company, Limited.

[A Lecture delivered to the London and Southern District Junior Gas Association, Nov. 12.]

In a lecture on the gas-fire delivered about two years ago to the Yorkshire Junior Gas Association, at Leeds University,* the development which had taken place since the initiation of the work of the Gas-Heating Research Committee was discussed. It is proposed now to continue with the theme, and to indicate and discuss the modifications with regard to gas-fire matters which have been introduced during the last two years. For the sake of continuity, the subject will be dealt with much along the lines taken in the earlier lecture.

Determination of Radiant Efficiency.

On the occasion referred to we were able to show, as the result of work carried out in our Warrington laboratories, that the apparatus used in connection with the "Leeds" test was open to considerable objection. This, so far as we are aware, constituted the first published criticism of the "Leeds" apparatus. Firstly, a number of results were cited to show that the distribution factor for the gas-fire under test, when determined by means of the Rubens thermopile, would probably contain an appreciable error, and that, if comparative distribution results were to be obtained, a standard method of procedure must be decided upon and adhered to rigorously. Adopting such an expedient, it was indicated by the data published that the results obtained, while more accurate for the purpose, might still contain an error, owing to the inherent weaknesses of the Rubens pile. Since our original reference, attention has been called once again to the importance of the realization of the limitations of this thermopile, in a paper read recently before the Royal Society by Professor Bone and his co-workers.†

Then, again, it was mentioned that the "R.H.S." radiometer would not allow of accurate results being obtained. There has appeared recently in the Technical Press‡ an account in considerable detail of the experimental evidence which led to this assertion.

It appears to us to be essential that more reliable appliances should be used in connection with the "Leeds" method of gas-fire testing, and also that a detailed description of the method of carrying out a test should be published, so as to avoid errors such as are known to have occurred in the use of the original apparatus. For example, in the determination of the magnitude of the correction to be applied to compensate for the heat absorbed from, or emitted to, the surroundings by the absorbent surface of the radiometer under the conditions of test. We have felt that, owing to the universal applicability of the Leeds test, there might be objection to interference with the principle of the method, which appears to involve only two assumptions:

(*a*) That the thermopile readings taken at the centre of each of the areas of the hemisphere truly represent the mean density of the heat for each of the areas.

(*b*) That the conditions under which the readings are taken ensure their being strictly comparable.

Given suitable testing instruments these assumptions are correct, or so nearly correct as to be permissible.

The use of the Rubens thermopile especially invalidates the second assumption; so that it is desirable that a thermopile or similar instrument should be constructed which will be capable of giving comparable results under the conditions of test. The ordinary Rubens thermopile which we use, if placed in the 0/0 position in front of the ordinary 10-inch modern gas-fire, and connected-up to a sufficiently sensitive Paul unipivot galvanometer, can be made to give a centre reading of 30 without the necessity of employing the collecting cone normally supplied with the instrument. In the case of our own particular instrument, when exposed to the fire, the attached galvanometer needle will move steadily to the maximum, which is attained in 20 seconds. Further continued exposure of the pile to the source of heat results in a steady falling-off of the deflection.§ In the 1913 lecture, one instance was cited where negative values were obtained in the 80 west position during a test, after the pile had been exposed to the fire in the 0/0 position for some time. To eliminate this defect, the expedient was adopted first of water-jacketing the thermopile case. No better results were obtained, however, indicating that the trouble was not connected merely with the heating-up of the case of the instrument. We have constructed a thermopile in which we have been able to ensure that the decrease in the deflection which occurs with the Rubens pile shall not take place.

As an indication of the constancy obtainable with this instrument, we would draw your attention to the following figures, showing the deflection resulting when placed for an excessive period of time in front of a gas-fire under conditions which would produce a decrease in the galvanometer deflection with the Rubens thermopile:

Fire, 10-Inch Flat Fronted.

Time.	Deflection.
0 mins.	0·0
1 ,,	69·7
2 ,,	69·3
3 ,,	69·2
4 ,,	69·5
5 ,,	69·3
6 ,,	69·8
7 ,,	69·6
8 ,,	69·3
9 ,,	69·4
10 ,,	69·3
15 ,,	69·0
20 ,,	68·9
25 ,,	69·1
30 ,,	69·2

In carrying out the "Leeds" test, it should not really matter whether the centre of the fire is placed absolutely at the centre of the hemisphere or not. In fact, in the case of very many fires, it would be difficult to decide upon the centre of the fire. For example, are we to measure from half-way up the radiants or not? In few, if any, cases are the radiants uniformly heated; so that the "radiant centre" would probably be nearer the bottom than the top. Then, again, would the presence of a fender not affect the position of this radiant centre? Further, should one measure from the front or the back of the radiants, or half-way through the radiants, or even from the front of the bricks?

If, then, the position of the fire is to affect the accuracy of the results obtained by the "Leeds" test, one has first of all to discover the radiant centre for each pattern of fire; and in this case the method would be open to serious objection on practical grounds. The "Leeds" test aims at measuring the radiant energy at the surface of an imaginary hemisphere situated in front of the fire. If the latter is placed in such a position that all the radiant energy which, under normal circumstances, would come into the living-room, passes through the surface of the hemisphere, correct results should be obtainable. It is only in connection with the estimation of the energy as it crosses the hemisphere that assumption is involved in the "Leeds" tests; and the validity of the assumption will depend on the appliances used, rather than on the absolute position of the fire.

The following results obtained during tests with a fire serve to show that, in this particular case, the appliances used—a Rubens pile and a Richmond radiometer—gave concordant results, even when the fire was not set absolutely at the centre of the hemisphere. In each case all the effective radiant energy from the fire passed through the surface of the hemisphere.

10-Inch Bow-Fronted Fire.

Position of Fire.	Radiant Efficiency (Mean of Two Tests). Per Cent.
(A) Centre of radiants at centre of hemisphere.	44·2
(B) Fire lowered 2 inches from (A)	44·9
(C) Fire raised 2 inches from (A)	44·5
(D) Fire 2 inches in front of (A)	44·7
(E) Fire moved 2 inches east of (A)	45·5 (one test only).

The only absolute determination of radiant energy made during the "Leeds" test is the radiometer determination carried out in the 0/0 position. In using the Rubens thermopile for estimating the relative intensity of the radiant heat on the 81 areas of the hemisphere, we are assuming that the portion of each area really investigated is representative of the whole. In the case of flat-fronted fires, the results obtained are, in this respect, within the general limits of accuracy of the Rubens instrument. The general arrangement of the absorbent surface with reference to the inlet in this instrument is, however, far from satisfactory, with the result that a small displacement of the instrument will largely affect the galvanometer reading. Provided, however, that the pile is clamped so as always to face in the same direction throughout the test, the distribution factor for a flat-fronted fire situated at the centre of the hemisphere is but little affected. When the fire is markedly to one side of the centre, a noticeable deviation occurs.

Appended are some distribution figures $\left(\frac{\text{total}}{\text{centre}}\right)$ for the area between 10° north and 10° south for a 10-inch bow-fronted fire. The thermopile was used without a collecting cone.

Fire Position.

—	Central.	2 Inches to Right.	4 Inches to Right.
(1) Rubens pile facing centre	6·31	6·59	7·37
(2) Rubens pile turned slightly to right	6·38	6·46	7·06
(3) Rubens pile turned further to right	6·39	6·16	6·61

The setting of the pile in (3) was noticeably incorrect, and such as not likely to occur in actual practice.

The effect of the collecting cone on the factor given above is indicated by the following—thermopile facing centre of hemisphere:

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* See "Journal," Vol. CXXIV., p. 513.

† *Ibid* Vol. CXXX., p. 72.

‡ *Ibid* Vol. CXXIX., p. 316.

§ Attention must be called to the fact that this experience does not concur with that of Messrs. Bone, Callendar, and Yates, who state: ". . . the deflection rises to about 25 mm. in 15 to 20 seconds, and creeps up to 27·5, a further 10 per cent., in 3 or 4 minutes. The deflection then diminishes to about 25 mm. if the exposure is prolonged on account of rise of temperature of the case, which may amount to 5° or 10° C."

Fire Position.

—	4 Inches to Left.	2 Inches to Left.	Centre.	2 Inches to Right.	4 Inches. to Right.
Without cone	7·16	6·54	6·30	6·45	7·11
With cone	7·62	6·82	6·30	6·39	7·31

The type of error which may be introduced in a determination using a thermopile constructed on the lines of the Rubens instrument—apart from the defect indicated earlier, that the actual galvanometer readings may not be strictly comparable—is indicated in the above. The variation with the fire 2 inches to the east, due to the incorrect setting of the pile, is not so marked; and under these circumstances (as already indicated) concordant efficiency results are obtainable. In the case of the fire experimented with, which was almost flat-fronted, it is only when the appliance is definitely set well away from the centre of the hemisphere that the error is noticeable. Nevertheless, the method of test should not be dependent upon the manner of heat distribution. If possible, the thermopile should be so constructed as truly to represent the relative heat density at the various points over the whole surface of the hemisphere, both under any conditions of distribution and for the complete range of radiant intensity produced by the varying sizes of fires. Even though concordant results may be obtained with the Rubens thermopile, it is apparent from the above that a constant error dependent upon the size of the radiating surface may nevertheless be introduced.

RADIOMETER.

A detailed description of the Richmond radiometer was published in the "JOURNAL"* some few months ago. The instrument is simple in form, consisting of an absorbent body—a metal block of known specific heat—suspended in a suitable enclosure. Determinations of the change of temperature of the block are taken prior to, during, and after exposure to the fire. The results obtained enable the centre reading for the "Leeds" test to be computed. A radiometer test can be completed in less than 20 minutes; so that by its use an appreciable saving of time in the testing of a fire can be effected. Highly concordant results can be obtained by the use of this instrument in connection with the "Leeds" method of test, and it overcomes the various errors introduced by the use of the R.H.S. radiometer.

On the whole, with the new radiometer we obtain somewhat lower centre readings than resulted from the use of the R.H.S. radiometer. On the other hand, with the new thermopile we would appear to obtain somewhat higher distribution factors. The net result will be in all probability that the general efficiency figures will be found to be somewhat lower than those obtained with the original Leeds apparatus.

THE HYGIENIC STANDARD.

During the last two years, we have seen the universal adoption of a more stringent hygienic standard with relation to the products of combustion from the gas-fire; and it is gratifying to think that this development was initiated internally, and was not forced upon us by external opinion. Although at first contested by a certain manufacturer on the ground of principle, the case in favour of the departure, already strong, appeared to me to be indisputable when we were able to show that, by proper canopy construction, high canopy fires could be made fume proof.

Out of the controversy concerning the escape of products of combustion from gas-fires under certain ideal conditions there has crystallized a simple standard test, which possesses the additional merit that it comes from an independent source. The test is that now known as the "Lancet" test, with which you are all familiar.

With regard to the actual hygienic standard, fires have been constructed which pass the "Lancet" test unaided by any chimney pull. In May, 1913, Richmond and Co. submitted for examination a series of fires, all of which were found to pass the test unaided when standing in the middle of a room. After reporting the result of their test, the "Lancet" stated, with regard to the standard, ". . . for ourselves we are inclined to accept that, when by an open test a gas-fire shows no leakage with (say) a 2 feet flue attachment (supplied by the makers of the fire), all that is required by hygienic consideration has been done."

Attention is called to this competent expression of opinion, owing to the tendency of manufacturers to adopt excessively large flue outlets in their endeavour to make the fires pass the "Lancet" test when standing in the middle of a room—a stringent condition.

Having conceived of the ideal, it was naturally more easy to attain this with a low-canopy gas-fire than with a high-canopy fire. With a low-canopy fire, however, the additional air which passes through the flue outlet along with the products of combustion may be compelled to pass over the upper portion of the radiants; and in that case there will result a decrease in radiant efficiency under chimney pull. On the other hand, with a high-canopy fire, provided the flue outlet is sufficiently small, it can be ensured that the fire shall not suffer in radiant efficiency when under the influence of chimney pull. If, however, even with high-canopy fires of the types at present made, the flue outlet be increased unduly, the constructional advantage of the high canopy is destroyed. For example, fig. 1 shows the section of a fire which passes the "Lancet" test unaided by chimney pull, and does not suffer in radiant efficiency when subjected to chimney pull. The size of flue outlet is 10 in. by $1\frac{3}{4}$ in. If, however, the flue outlet is increased to $11\frac{1}{8}$ in. by $3\frac{1}{8}$ in., the efficiency of the fire is then affected by chimney pull, and a drop in efficiency of 2 per cent. results (from 54 per cent. to 52 per cent. in the actual test) when the fire is subjected to the pull of the chimney in the test-room. The distance from the canopy inlet to the top of the radiants in this particular fire is $4\frac{1}{2}$ inches. Then, again, considering merely the framework of the fire, the canopy is, in many cases, the hottest portion exposed; so that if an excessive amount of air is allowed to pass along with the products of combustion, this part becomes unduly cooled, with the result that there is a decrease in the small amount of convected heat otherwise available.

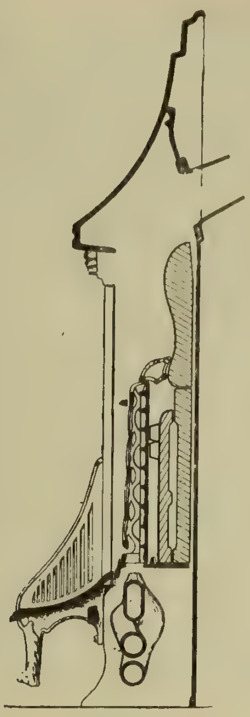

Fig. 1.

It is gratifying to notice that the high-canopy fire constitutes the major portion, if not the entire portion, of the new types of fire constructed by various makers. This type of construction is commendable on all grounds; but it is essential that the development shall not bring in its train large flue outlets. These are not advisable in conjunction with the present-day gas-fire, even though they may have an advantage to commend them when the fireplace is sheeted-up completely, without provision for ventilation.

The provision of a large flue-outlet will in most cases, despite a high canopy, involve an excessive decrease in the thermal efficiency of the fire when the latter is in actual domestic use. In order to oust the coal-fire more completely, it will not be sufficient merely to rely on the concomitant advantages of the gas-fire, but will be necessary to produce an appliance which shall show an advantage over its rival in actual fuel costs in prolonged use. To attain this ideal, it is essential that the gas-fire manufacturers on their part shall conserve to the best of their ability the thermal energy available, and, if possible, only allow heat to pass into the chimney after it has yielded the maximum of useful work.

CONVECTED HEAT AND THE GROSS THERMAL EFFICIENCY OF GAS-FIRES.

It can be calculated that, roughly speaking, 75 per cent. of the thermal energy of the gas is available for distribution as radiant energy, assuming that the fire is incandescent to the top of the radiants. To attain this 75 per cent., it is essential that there shall be no excess of air passing through the radiants, and no transmission of heat through the back of the fire. The practice is general to estimate directly the radiant efficiency of a gas-fire, determine the flue heat, and assume that the residue is available as convected heat. In extremely few cases will this apply. In the case of rooms where it is necessary to ventilate by means of the fireplace, the proper fitting of the fire would involve a considerable increase in the direct chimney heat beyond that indicated by the flue loss determination. Even in the majority of the cases where the regretable practice is adhered to of blocking-up entirely all secondary inlets to the chimney place when the gas-fire is fitted, there is a considerably greater amount of heat passing up the chimney directly than is estimated under the head of flue loss. If any ordinary pattern of fire which has been alight for some time is examined, it will be noticed that the back casting is hot. The area of the back casting is, in many cases, as great as, if not greater than, the area of the front casting of the fire, and in addition it is also markedly hotter. So that, even if the heat emitted by radiation from the back casting were negligible, it is apparent that the figure given as convected heat, under the conditions cited above, must at least be divided by two, as the heat from the back casting passes directly up the chimney in nearly every case. Suppose the radiant efficiency of the fire to be 50 per cent., and the flue heat under chimney pull 30 per cent., we have a residue of 20 per cent. It is apparent, therefore, that of this residue not more than half—namely, 10 per cent.—can be available as convected heat. Actually, I believe that the convected heat is appreciably less in amount than this in the majority of cases. The gross heating efficiency of the majority of fires is less than 60 per cent.

Owing to the unsatisfactory conditions produced by the older types of gas-fires, which heated to a considerable extent by convection, there has resulted the production of an appliance which gives off a very small amount of convected heat. At times in rooms heated by gas-fires the temperature of the air is raised rapidly owing to unsatisfactory ventilation, and there are produced air conditions somewhat similar to those resulting from primary convected heat—in this case due to a secondary effect. Suppose the ventilation is satisfactory and the gas-fire is consuming 30 cubic feet of coal gas per hour, and that an additional 5 per cent. of the available energy could be transmitted to the room as convected heat, is it contended that the effect of this additional 5 per cent. will be harmful? It would be equivalent, from the thermal energy point of view only, to having alight in the room one bijou incandescent fitting consuming 1½ cubic feet per hour. In any case it will probably be desired for the temperature of the air of the room to be raised to (say) 63° Fahr.; and such a heating of the air will involve thermal transmission by convection. Surely, therefore, it is permissible to assume that some convected heat is allowable for this purpose, apart from any consideration of increased air movement. It is not inconceivable that the amount of convected heat allowable may be directly connected with the amount of radiant heat supplied, and that, as the radiant efficiency of the fire is increased, more direct convected heat may be admitted without producing unwholesome conditions in the living-room.

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* See "JOURNAL OF GAS LIGHTING," March 30, 1915.

For these reasons, it appears to be advisable to retrace to some extent our footsteps in gas-fire construction, as—intentionally or otherwise—the over-all thermal efficiency of the modern gas-fire is determined almost entirely by its radiant efficiency. Of the energy available from the coal gas we can better afford to have, at any rate, a portion of it in the room as convected heat than up the chimney as chimney heat, assuming, of course, that the energy cannot be obtained primarily as radiant heat. From 5 per cent. to 10 per cent. of the total energy available, which is now transmitted directly to the chimney, can be recovered simply as convected heat. It may then be possible to approach the point of over-all thermal efficiency of 65 per cent. in the case of the best fires, fitted as is generally done. Adequate ventilation will probably provide the quietus for the now over-rated convected heat bogey.

VENTILATION.

The formation of a Committee and the initiation of the ventilation research at Leeds University has attracted the attention of manufacturers, and there are now fires on the market which have been designed more especially for the purpose of satisfying those methods of fitment which necessitate the provision of ventilation arrangements on the stove itself. In the case of our own fires, there are three simple methods available for providing such ventilation arrangements:

(1) The provision of sufficiently large inlets to the dead-space between the two canopies, resulting from the adoption of the type of canopy construction which we advocated two years ago.
(2) The provision of air-ports at the edge of the fire.
(3) The adoption of a largely increased flue-outlet.

The adoption of systems (1), (2), or (3) will be determined by consideration of:

(*a*) The ventilation effect available or desirable.
(*b*) The additional thermal losses involved.

Unfortunately, competent opinion is divided on the question of the amount of air required for ventilation; and even if it were settled that there should be *x* changes of air per hour, no two rooms would provide identical conditions. Speaking generally, the coal-fire which we desire to replace does not noticeably over-ventilate the room; so that we shall probably be going on safe ground if the fire is so constructed that the effect produced is near the maximum possible with the average house chimney.

The following factors will affect the ventilation occurring in a given room:

(*a*) The resistance to the inflow of air to the room.
(*b*) The resistance to the inflow of air to the chimney.
(*c*) The resistance to the flow of air through the chimney.
(*d*) The chimney heat available.
(*e*) The internal heat available owing to the warming of the air in its passage through the room itself.
(*f*) The aëro-motive force due to the movements of the external atmosphere.

Of these, only (*b*), (*d*), and (*e*) can be controlled, in any way, at the stove. With regard to (*b*), this is determined by the area of the inlet to the chimney, in those cases where the openings are simply in the nature of one or more orifices in a thin plate. If the inlet is in the nature of a passage, it will be influenced by the design of the passage. The attainment of the best design in this case might be a troublesome matter. It is simpler to make the inlets of the type of thin plate orifices. The maximum ventilation is often obtained when the fire is set at the foot of a chimney without the fire-place being blocked-up in any way.

COAL-FIRE CONDITIONS.

To understand the conditions existing, it will now be worth while considering the case of the coal-fire, which may be found discussed in detail in some of the standard works on ventilation. In this case, the total resistance to the air flow through a room is made up of the resistance of the inlets R_1 and the resistance of the outlets R_0. If the aëromotive force is represented by A, and is assumed to be constant, the ventilation V is given by the equation:

$$A = (R_1 + R_0) V^2$$

But the A.M.F. "A" is determined by the relation between the temperature outside T_0 and the temperature of the flue T_f, and in any particular case, assuming T_0 is constant, can be given by:

$$A = k\,(T_f - T_0).$$

If H = the total heat available.

$$T_f - T_0 = \frac{cH}{V}$$

Where *c* is a constant depending on the specific heat of the air and the units employed.

$$\therefore A = \frac{KH}{V}\ (K = kc)$$

$$\therefore \frac{KH}{V} = (R_1 + R_0) V_2$$

$$KH = (R_1 + R_0) V^3$$

If the inlets to the room are so large that R_1 is negligible, we get maximum ventilation.

$$V = \sqrt[3]{\frac{KH}{R_0}}$$

With the doors and windows closed and the air entering by chinks, the ventilation is at the minimum given by:

$$V = \sqrt[3]{\frac{KH}{R_1 + R_0}} \quad . \quad . \quad . \quad . \quad (a)$$

From these relations, it follows that it will be a difficult matter largely to increase the ventilation taking place by increasing the chimney heat. The heat supplied would require to be increased eight times to double the ventilation. Further—and this is of importance to gas-fire manufacturers—cutting down the direct losses at the chimney will affect the ventilation to a considerably smaller degree, especially as it is to be remembered that of the heat emitted to the room by the fire a considerable portion passes eventually into the chimney. With a given difference of pressure, the flow varies as the area of an orifice. But, as mentioned, the square of the flow is proportional to the pressure, therefore, $V^2 \propto a^2A$ when *a* is the area of the thin plate orifice. Thus, doubling the effective area of an inlet will decrease the resistance of that port to ¼, and by definition $R = \frac{1}{ca^2}$ where *c* is a suitable constant.

VENTILATION BY MEANS OF THE GAS-FIRE.

Now, of the three systems of ventilation mentioned previously the conditions for (3) are similar to those of a coal-fire, but with (1) and (2) are slightly different. By noting the increase of air flow resulting by increasing the subsidiary inlets in system (2), we obtain results which, when plotted to show the relation between the total area of the chimney and the total ventilation taking place, give a curve of the form shown by the full line in fig. 2.

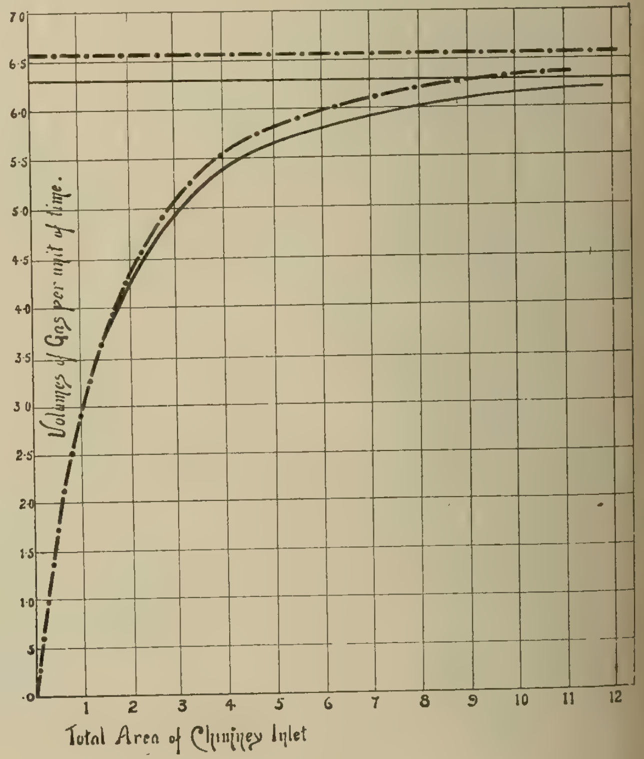


Fig. 2.

On the same diagram, there is shown a curve [broken line] calculated for the case of a gas-fire ventilating solely by means of the flue opening—the condition analogous to that of the coal-fire. The horizontal lines represent the maximum ventilation that is attainable when the resistance of the inlet to the well at the bottom of the chimney has fallen to zero. These curves have primarily a theoretical basis, and have been applied to an experimental chimney which discharged inside a lofty room in which the tests vere made. The conditions were thus such that the question of he entrance of air to the room had not to be considered. The units of area and resistance taken are those of a 3-inch square pening in a thin plate.

In fig. 3, the results for the fire with the subsidiary openings are analyzed, and the type of variation in the amounts of air passing through the flue-outlet and the subsidiary openings are ndicated. Starting with the subsidiary openings closed, the total ventilation passes wholly through the flue-outlet. As the subsidiary openings are increased, a point is soon reached at which qual quantities pass through the flue and the openings. While ncrease in the side openings swells the total amount of ventilaion occurring, the actual amount passing through the flue-outlet

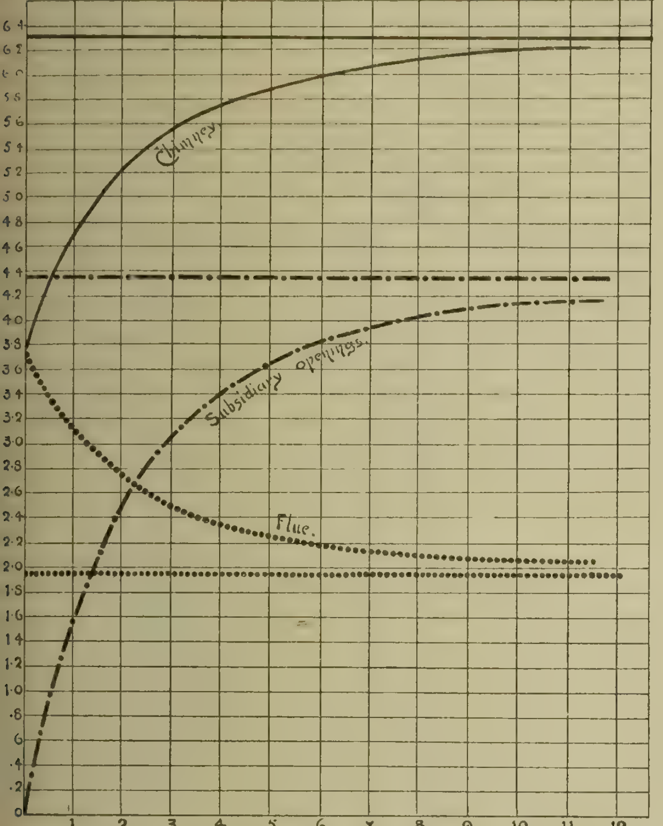


Fig. 3.

rogressively decreases. The total ventilation, which is equal to e sum of the amount passing through the two inlets, is given by e full line curve marked "Chimney." If it is desired that the entilating air shall not be drawn through the flue-outlet (and one the chief reasons for employing subsidiary openings is to avoid is), then the desirability of having these subsidiary openings ppreciably larger than the flue-outlet is emphasized by these rves. The asymptotes of each curve are also shown. Given certain definite area of inlet, another advantage in making the e-outlet as small as permissible, consonant with the satisfaction the hygienic standard, and employing subsidiary openings for the ntilation, is that the A.M.F. of the fire itself will thus be kept as gh as possible, and the effect of a momentary down-draught on e passage of the products of combustion up the chimney will e less marked. A fitting with a suitable flue elbow is also to be commended on this ground.

Fig. 2 indicates that, viewed solely from the standpoint of oving air through the chimney, there is a small advantage in vour of the large flue-outlet and small subsidiary openings, as e broken line curve represents the limiting condition when the ea of the latter inlets is zero. The magnitude of the difference etween the results obtained by the two methods of ventilation is, owever, dependent upon the length of the chimney-shaft, and, as ven by the curve, represents the conditions for a chimney 14 feet ng. With a longer shaft, such as would be met with in actual actice, or with an additional A.M.F. produced by some external encies, the two curves would more nearly coincide. In the ent of there being a shorter shaft, there would be more divergence than shown.

The difference between the results in the two cases is underood, when it is remembered that there are two distinct A.M.F.'s erating:

(1) That of the fire, dependent upon its flue loss, which affects its ventilation through the flue-outlet.
(2) That of the chimney-shaft, dependent upon the flue loss of the fire and the back casting loss, which produces the ventilation through the subsidiary openings, and also influences that through the flue-outlet of the fire.

In fig. 4 are shown graphically the results which would be obined in shafts similar to the chimney under consideration, but

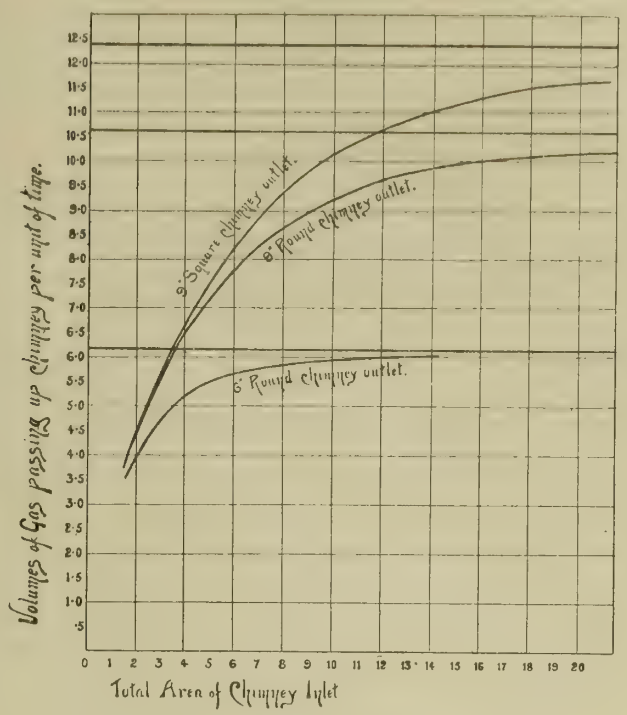


Fig. 4.

with outlets of three different sizes; these outlets representing the smallest cross section of the shaft. For the sake of the illustration, it is assumed that the smallest cross section represents the thin plate orifice area corresponding to the resistance of the chimney.

It is of interest to note that when the total area of the inlet to the chimney is equivalent to the thin plate orifice area corresponding to the resistance of the shaft, about 80 per cent. of the maximum ventilation possible with the chimney is obtained. In the case of the chimney with a 9-inch diameter circular outlet with a total inlet area of 7 units, ventilation of approximately 8·3 volumes was obtained out of a theoretically possible maximum of 10·6 volumes. If for some reason, such as the presence of bends, the resistance of the chimney is greater than that corresponding to the thin plate orifice of resistance equal in area to the outlet, the effect would be similar to that obtained with a correspondingly smaller outlet in the type of chimney which we have considered.

RESISTANCE OF INLET TO THE ROOM.

So far we have only discussed the effect of chimney resistance. In an actual living-room we have operating, in addition, the resistance of the inlet to the room; and, in the majority of cases, this latter will not be negligible. It is, then, of interest to see what would be the effect of this added resistance on the efficiency of a gas-fire for ventilation purposes. In fig. 5, we have plotted against the room-inlet area, the ratio between the ventilation taking place with a gas-fire with a resistance of inlet to chimney equal to the resistance of the chimney-shaft, and that possible with the same fire if it provided no resistance of inlet to the well at the foot of the chimney. The form of the curve is interesting, and indicates that with increasing room-inlet resistance the relative efficiency of the gas-fire as the ventilator increases from the 80 per

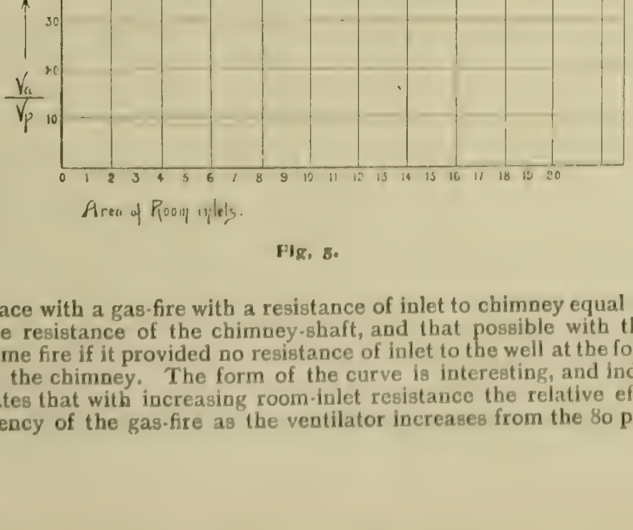


Fig. 5.

cent. minimum already mentioned, although, of course, the actual air transmitted decreases in amount owing to the extra resistance in the circuit. In other words, the greater the resistance of the inlets and the outlets to the room itself, the less important does the resistance of the fire become.

Analysis of Conditions.

Figs. 2 to 5 were deduced from an early series of experimental results which were found to be vitiated by certain errors due to (*a*) thermal losses from the chimney walls, and (*b*) unsuspected leakage of air into the chimney. The importance of these faults became apparent during the critical examination of the results, necessary in the endeavour to construct a general curve. The errors were greatest in the lower reaches of the curve, where the inlet areas were small and the chimney temperature relatively high. The curves were, therefore, deduced from the higher values, and represent a first approximation to the actual conditions.

The small difference noticeable between the actual results given in figs. 2 and 4 for the 6-inch round chimney are due to a small change made in the constants which are obtained from the final equation by trial. The preceding curves, however, serve their purpose, which is to indicate in a general manner the effect of the various operative factors on the results obtained.

For the purpose of the present lecture, it was felt desirable to repeat the critical series of tests on which the previous generalizations were based, taking precaution to overcome, so far as was possible, the errors given under (*a*) and (*b*) above. The actual experimental results are shown, together with the theoretical curve, in fig. 6. The concordance is surprisingly good, and justifies the use of the Pitot tube in conjunction with the Threlfall micromanometer, which we adopted, for determining the relative volumes of air passing in our tests. To emphasize the concordance, the observed and calculated values are tabulated below:

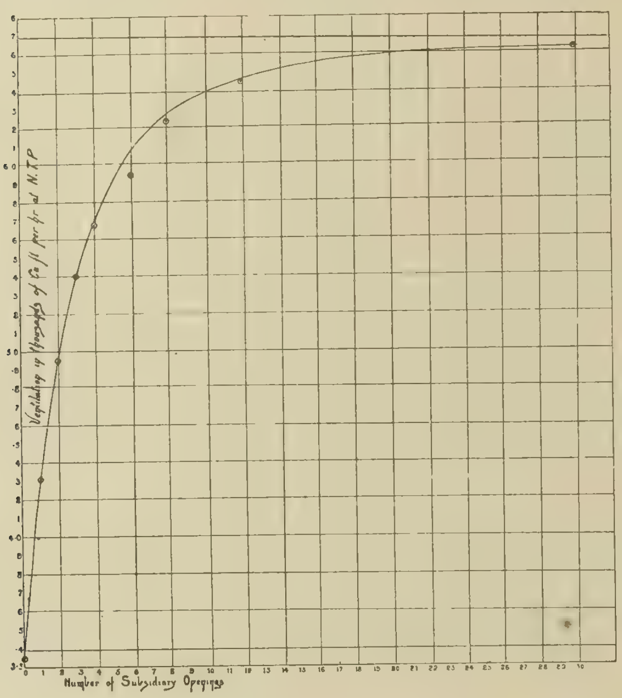


Fig. 6.

		Calculated.	Observed.
When a_s = 0	V =	3·345 ..	3·345
1		4·31 ..	4·31
2		4·96 ..	4·96
3		5·40 ..	5·40
4		5·70 ..	5·68
6		6·08 ..	5·95
8		6·28 ..	6·24
12		6·47 ..	6·45
20		6·60 ..	—
30		6·64 ..	6·64
Infinity		6·69 ..	—

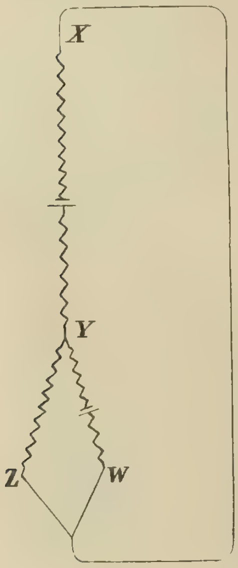


Fig. 7.

In fig. 7 is represented the electrical analogue of the system of ventilation by the gas-fire which we are considering. The seats of the A.M.F. are represented by cells, and the resistances by the zig-zag lines. The circuit is linked-up by plain lines of no resistance representing the surrounding atmosphere. This method of analysis of ventilation problems suggested by Shaw has enabled us to arrive at general equations representing the volumes of the ventilation through the various parts of the circuit.

Let V = ventilation through YX the chimney.
V_1 = „ „ ZY the subsidiary inlets.
V_2 = „ „ WY the fire flue outlet.
R_s = resistance of ZY.
R_f = „ WY.
R_c = „ XY.
a = A.M.F. in WY = $\frac{kH}{V_2}$ where H = flue heat.
A = A.M.F. in YX = $\frac{k^1H^1}{V}$ where H^1 = chimney heat.

Then it can be deduced that

$$V = \sqrt{\frac{\frac{kH}{V_2}}{R_f + \frac{R_sR_c}{(\sqrt{R_s}+\sqrt{R_c})^2}}\left[\frac{R_s}{(\sqrt{R_s}+\sqrt{R_c})^2}\right] + \frac{\frac{k^1H^1}{V}}{R_c + \frac{R_sR_f}{(\sqrt{R_s}+\sqrt{R_f})^2}}}$$

and

$$V_2 = \sqrt{\frac{\frac{kH}{V_2}}{R_f + \frac{R_sR_c}{(\sqrt{R_s}+\sqrt{R_c})^2}} + \left[\frac{R_s}{(\sqrt{R_s}+\sqrt{R_c})^2}\right]\frac{\frac{k^1H^1}{V}}{R_c + \frac{R_sR_f}{(\sqrt{R_s}+\sqrt{R_f})^2}}}$$

These equations are cumbersome, and for solution require four experimental points to determine the constants. They have been applied in plotting figs. 2 and 3.

The experience gained in this manner indicated a probable close agreement between the ventilation by system (2) and system (3). The latter can be represented by the more simple equation (*a*), already given; and it appeared quite likely, therefore, that by a suitable modification of constants, a similar equation sufficiently exact could be obtained for the system (2) under examination.

The curve fig. 6, which is in close agreement with experiment, is plotted by means of the relation which we have now derived.

$$V = \sqrt[3]{\frac{K}{R_c + \frac{1}{(a_s + a_f)^2}}} \quad . \ . \ . \ . \ (b)$$

Where K, the effective A.M.F., is dependent in any particular case on the heat available.

a_s = thin plate orifice area corresponding to the subsidiary inlets.

R_c and a_f are empirical constants determinable by experiment, and are roughly equal in magnitude to the resistance of the chimney and area of the flue outlet respectively. They may be defined as the effective resistance and conductance respectively of the two passages. By the determination of three points on the curve by experiment the constants can be derived and the full curve plotted.

The full line curve fig. 2 was calculated from the complicated relation previously given, assuming $R_c = 0{\cdot}100$ and $a_f = 1{\cdot}535$. On adapting the equation (*b*) to this particular curve, the values for the constants became $R_c = 0{\cdot}102$ $a_f = 1{\cdot}604$. Under these circumstances, the curves from the two equations will coincide. Although the equation representing the ventilation by the systems which we have designated (2) and (3) are similar, and the corresponding curves are of the same general shape, they are not quite identical, owing to the fact that the constants involved are different, due to the effect of the subdivision of the A.M.F., even although the actual conditions in system (2) where $a_s = 0$ are those of the system (3).

The Primary Essentials for Ventilation.

From what has been stated, it would appear that, in making provision for ventilation in gas-fire fitting, the following points should be observed:

(*a*) As large an inlet as practicable, to the well at the bottom of the chimney, should be made available.
(*b*) That the ventilation produced is practically the same whether it be done by means of a large flue-outlet or by subsidiary openings of equal effective resistance.
(*c*) That if subsidiary openings be employed, they should be appreciably larger than the flue-outlet of the fire.
(*d*) That when the effective resistance of the inlet is equal to that of the chimney-shaft, at least 80 per cent. of the ventilation possible with the thermal energy available can be obtained.
(*e*) That the rate of increase of ventilation with decrease of inlet resistance falls off rapidly towards the end of the curve, and that but little advantage accrues by increasing the inlet area beyond that of the effective cross section of the shaft.

[Note.—It is important that the effective cross section should not be confused with the actual cross section. By effective cross section is meant the thin plate orifice area, of resistance equal to that of the shaft.]

Distribution of Radiant Heat.

Progressive gas-fire makers endeavour persistently to increase the thermal efficiency of their appliances along lines which will ensure the attainment of suitable conditions in the living-room. Hitherto there has been no serious attention paid to the question of the manner of distribution of the radiant energy emitted by the gas-fire. Fires with vertical radiants have been to all intents lat-fronted, with the result that it is found, on testing many of hem by the "Leeds" method, that the horizontal distribution of adiant energy roughly obeys the cosine law. Thus, when the hermopile is moved through 60° to the right or left of the meridian, he intensity of the radiation is found to have fallen to about one-alf. It would be advantageous to have a uniform distribution of heat horizontally in many cases, and in the case of a broad oom to have, perhaps, even a larger proportion of the energy lirected towards the sides of the fire than directly in front.

The "R.H.D." fire (fig. 8) introduced this year represents an ndeavour to provide an appliance capable of giving a more early uniform horizontal distribution of heat, and in construction s a marked departure from the usual practice. By virtue of its roperty of giving more nearly uniformly horizontal heat dis-ribution, there has been eradicated a fault common to the coal-re and to modern gas-fires. Obviously there are types of deeply-ecessed grates in which there would be no advantage, but even disadvantage, in fitting this fire. With the majority of grates will be found, however, that the front line of the fire casting rojects sufficiently beyond the back portion to enable the fire to ılfil its object economically.

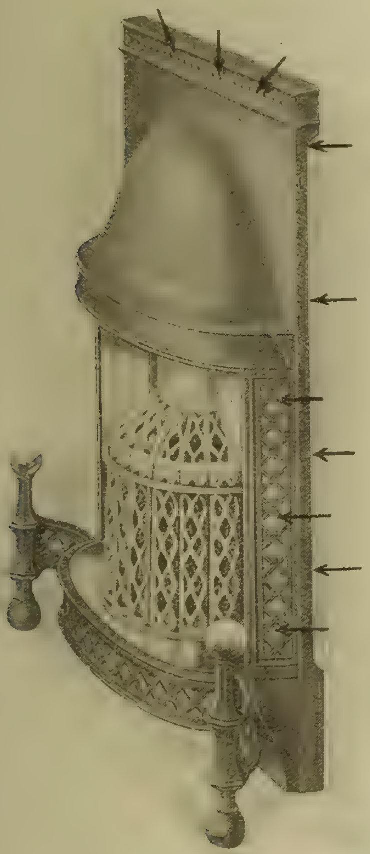


Fig. 8.—The "R.H.D." Gas-Fire.

Appended are results showing the variations in the intensity of ıe radiation as indicated by the Rubens thermopile during the Leeds" test on moving from the centre to the sides of the fire ı the case of the "R.H.D." gas-fire and an equivalent size flat-:onted fire.

	"R H.D." Fire (9 Radiants).					Flat-Fronted Fire (9 Radiants).				
Longi-tude.	0.	20.	40.	60.	80.	0.	20.	40.	60.	80.
S. .	25·2	24·8	22·5	17·4	4·3	39·0	37·5	32·1	18·7	3·1
quator	29·6	29·0	27·4	22·5	11·4	43·8	42·2	36·8	23·3	5·5
N. .	31·0	30·5	29·7	26·8	15·2	42·3	40·9	35·1	22·7	5·2
N. .	27·7	27·4	26·9	23·4	13·4	35·0	33·4	28·0	17·1	4·0

Now, in this fire the radiants project beyond the line of the side asting; and we have to consider whether any disadvantage would ttach to this, in view of the possibility of criticism on the score f cross draughts. The position in this connection may be sum-ıarized as follows:

(*a*) Fires have been in use for many years in which all of the radiants, vertical and top, project beyond the line of the side casting whereas in the "R.H.D." fire there is some side protection, and the top radiants end behind these side wings.

(*b*) All flat-fronted gas-fires standing in the middle of a room fail under the action of cross draughts when subjected to the "Lancet" test, even when aided by a flue elbow.

(*c*) Tests have been carried out with the "R.H.D." fire and different makes of flat-fronted fire standing side by side, each with a flue elbow attached; and it was found that in all cases where the "R.H.D." fire failed, as a result of bodies moving across the front of the fire, the flat-fronted fire also failed.

(*d*) If cross draughts occur in the living-room, they will in general be discontinuous and of short duration, due to the movement of persons across the front of the fire or to the opening and shutting of doors.

(*e*) The general air movement in the neighbourhood of the fire in use will be inwards towards the chimney.

(*f*) When a draught has been artificially produced locally across the "R.H.D." fire, the turning of the air stream in through the side ventilating ports is well defined in actual use.

SILENT GAS-FIRES.

The production of the silent "G.A.A." which we announced in 1913 rendered possible the production of the silent gas-fire for general use. It is at least fifteen years since there was put on the market a gas-fire burner capable of giving a silent flame at high aëration. Fires with this attachment were open to objection, however, on the score of the unpleasant hissing sound associated with them. The importance of producing a silent gas-fire is indicated by the following excerpt from the "Lancet:"

> "We hope that further attention will be given to the irritating noise made more or less by all atmospheric burners. This fact undoubtedly creates a prejudice against the gas-fire, and the greater the noise the greater is the impression that the gas bill is going to be big. In the sick room, where the gas-fire is of the greatest service, it is particularly desirable that the sound of the gas and air being intermingled and interjected should not disturb the rest or equanimity of the patient."

A Richmond silent gas-fire was tested, and that it was found to be satisfactory is indicated by the following:

> "We have had one of these silent fires under observation in a bedroom for several days, and the result is very satisfactory . . . .; and it seemed incredible that gas was being consumed at the rate of 30 feet per hour in a cherry red fire giving a genial warmth and comfortable aspect to the room."

FLAME SILENCE.

Unless special provision is taken—as can be done by the insertion of a suitable device in the burner body or by making the capacity of the burner large—it is found that at high aëration the ordinary bunsen flame rattles. High aëration is not essential to the successful working of a gas-fire, nor, so far as our present knowledge of the subject allows us to say, is it advantageous. The degree of aëration necessary is determined at present by that required to prevent the sooting-up of the radiants—even a highly aërated flame will still cause a darkening of the gas-fire radiants. Sooting-up can be prevented by having in the flame, when the fire is hot, a defined inner cone which is not broken up by the radiant. This condition does not demand very high aëration.

There is a popular belief, which has been voiced recently in the gas industry, that flame silence can be obtained by ensuring good mixing of the gas and air passing to the flame. This view appears to me to be incorrect. Flame silence, just as jet silence, would appear to be dependent upon the elimination of objectionable eddies from the gas stream. This can be done simply by passing the mixture down a sufficiently long tube or by making the burner body ample. The following experiment shows the effect of eddies in causing flame rattle, and indicates that the phenomenon cannot be explained by any assumption of unsatisfactory mixing of gas and air: A piece of $\frac{3}{4}$-inch wrought-iron pipe about 26 inches long is provided with a drilled cap at one end. A short distance from this end there is drilled a hole in the side of the pipe. A gas-injector is attached to the other end of the pipe. Below the cap, and above the side hole, there are fitted two small screws which can be moved forward into the gas stream if required. With the screws drawn back, two silent highly aërated flames can be obtained at a suitable gas consumption. On moving the screws forward into the gas stream, the end flame can be made to rattle, owing to eddies set up in the pipe. That the obstruction does not interfere with the homogeneity of the mixture passing up the tube, is shown by the lower flame, which is unaffected and still burns silently.

Although flame silence can be obtained if the body be capacious, the resulting burner is cumbersome and possesses the objection that when the flame is extinguished there is a noisy explosion. To eliminate the eddies and, if desired, give flame silence at high aëration without the firing-back trouble, we have introduced in the gas-fire burner a metal grid built up of plates $\frac{1}{16}$-inch apart. This device produces the desired result, and has the advantage that the spaces in the eddy filter are so large as to avoid the collection of dust drawn into the burner along with the primary air, in the passages. The small pieces of fireclay that may at infrequent intervals fall on to the burner, cannot fall on to the grid, as the latter is not situated directly below the burner.

It is stated above that very high aëration does not appear to be necessary in the light of our present knowledge of domestic heating. It is often contended that the substitution of the highly aërated flame for the sluggish flame ensures an increase in the radiant efficiency. For this view we have not found support in the result of actual experiments. Tests which have been made at Warrington in this connection indicate that the change in radiant efficiency, if any, is rather a decrease with the adoption of a highly aërated flame in the ordinary gas-fire.

Degree of Aëration.		Centre Reading K.C.U. per Hour.	Radiant Efficiency.
Fire (A)	High	67·9 68·2	46·6 46·8
	Low	69·7 70·0	48·7 49·0
Fire (B)	High	54·8	44·3
	Low	54·6	44·2

Further the distribution factor is but little, if any, affected by the change in aëration. In the case of fire (B) the distribution factors at high and low aëration were respectively 21·65 and 21·83. The centre reading represents the net balance of heat actually absorbed by a black body of 1 square foot area at a distance of 34½ inches from the fire.

General Details.

It is desirable to obtain as much radiant heat from a gas-fire as possible, and, if it can be done, to prevent radiant heat being transformed into convected heat before it is admitted to the room. In this respect a number of small additions can be made to the total effect by attention to details. In the ordinary "Art Black" stove with projecting canopy and fender, unnecessary losses of radiant heat are sometimes incurred. For example, the following results for radiant efficiency were obtained from such a fire. They show the saving to be effected by the use of suitable reflectors.

Description.	Radiant Efficiency Per Cent.
All black	51·0
Nickel-plated fender	52·0
No fender	52·5
Nickel-plated fender and nickel reflector under canopy	53·3

In conclusion, thanks must be expressed to the Directors of the Richmond Gas Stove and Meter Company, Limited, for permission to publish the data presented, which have been obtained from experiments carried out under my direction in the Research Department, and acknowledgment made of indebtedness to those members of the staff of the department who have assisted materially in the collation and interpretation of the facts given, by a frank expression of their own views.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Supply of Gas in War Time—Toluol—The Case of Small Works.

Sir,—It is not with any hope of official assistance from either the Government or the Institution of Gas Engineers (of whom I form a unit of membership), that I pen these lines in support of "Provincial Manager" in his recital of present-day difficulties to the small works manager in particular.

There is obviously a case for both. "Provincial Manager" has pretty well covered most troubles now arising in gas-works. The Gas Associations seem powerless to offer any practical assistance where it is most needed; while the Government for whom we are now labouring at some sacrifice, stand by at a time when the maximum supply of toluol is available, and allow all sorts of labour troubles—from the "cribbing" of men at higher wages rates, to Government supported demands for unreasonable wages advances—to interfere with the unfettered efforts of managers to really do their best.

Here is our own case. During the past eighteen months—*i.e.*, May, 1914, to November, 1915, stokers wages have risen from 31s. 6d. to 39s. 6d. per week; annual holidays have been granted; and time-and-a-half added to Sunday labour. A contract of service, embodying the agreed terms, was signed as recently as last April; and so long as it suited their book, the stokers held on to the agreement. We now have a demand for more wages, notwithstanding the signed agreement and the increase already of 8s. per week; and on refusing the demand, we are presented with notices from all retort-house men.

We accept the challenge, and agree to take our chance. We are not whining, and recognize the circumstances as part of the game. But, we are one of the small works that have loyally taken up the matter of toluol extraction, and spent some time and thought and supervision to obtain the best possible results. We have succeeded to the extent of getting two gallons of toluol extra per ton of tar, which normally contains less than half-a-gallon.

We have made certain sacrifices in carbonizing results—not compensated for by what the tar distillers offer us by the toluene. In fact, after correspondence lasting from last July, we are unable to agree with them as to the amount of toluene added per ton of tar. Their figures are less than half those of Professor Frankland. Some encouragement here!

As I previously said, we are a small works—under 30 millions per year. We shall carbonize 2700 tons of coal, and make 29,700 gallons of tar. In this tar we are placing 371 gallons of toluene by treatment, against 74 gallons in the tar untreated.

Unlike the gas engineer who came in for your editorial remarks last week, who wanted information in regard to the "C" process, we are doing everything possible to attain even better results than our present addition of two gallons of toluene extra per ton of tar. Some time and thought are being given to it, and some sacrifice of carbonizing results is being cheerfully undertaken by my Directors. Yet a body of men can deliberately wreck the whole scheme at a time when every gallon of toluene is most vital to the country and the maximum can now be obtained.

When I suggested to the Ministry of Munitions that gas-works should be declared "Controlled Establishments," under the present circumstances, I am simply referred to another department.

By the way, what has become of the unanimous resolution of the Midland Association of Gas Managers passed a few weeks ago—asking the Government to declare gas-works controlled establishments?

What several small works' managers would like to know is why the Institution of Gas Engineers cannot move and assist in such matters as:

(*a*) Preservation of labour at reasonable rates.
(*b*) Assist in a reasonable recognition by tar distillers of the value of our efforts in toluene extraction, when we have test figures by an acknowledged scientist to go by.
(*c*) Assist in obtaining badges and so retain indispensable distribution fitters. At present only those engaged on gas manufacture are granted service badges; yet what is the use of our making gas if we have not the means of maintaining its supply?
(*d*) Endeavour to obtain a declaration that gas-works are "controlled" for the period of the war, and so ease the labour troubles.

The British Commercial Gas Association took up a financial matter of great urgency for its members and laid some very sound arguments on the subject.

Just one parting shot as to the size of works which can reasonably adopt the "C" process. I recently saw a 14-million works at it; and they had bought and put in a small washer for the purpose!

These certainly are abnormal times, and we must not quibble too much. Still, there are certain aspects of gas supply in war time that are quite susceptible to smoother working by collective and authoritative representation.

There should be no question as to the size of works adopting the "C" process. If the plant is there, it should be used without any question.

A Small Provincial.

Nov. 12, 1915.

Sir,—With reference to your "Editorial Note," entitled "Toluol and Statutory Obligations—The Case of Small Works," in which you say that the size of works is immaterial, none being too small to help, I beg to express my disapproval of your statement unless qualified in the following manner: "No works having an engine and exhauster is too small to help."

Small gas-works with a make of under three million cubic feet per annum, where no exhauster is used, have the greatest difficulty in efficiently washing their gas for the extraction of ammonia, on account of the back-pressure; and were a tar-washer to be added to the plant, it would be almost impossible to get the gas through at all.

I mention this because there are many of these small undertakings throughout the country which are quite unable to render the assistance the "man in charge" would wish to give, though his patriotism, like Cæsar's wife, is far beyond suspicion.

C. G. Grimwood.

Sudbury, Suffolk, Nov. 11, 1915.

A British Trade Opening in Holland.

Sir,—We have now started our Gas Promotion Centre in Holland; and the first days of it give sufficient proof that it is a success. High prices for anthracite, and the fear for shortage in solid fuel, have an important influence on the promotion of gas for heating rooms.

We now intend starting the promotion of industrial gas. But the great thing is to get the appliances here. All sorts of furnaces, heaters, and burners have to come from the United Kingdom; and you know that all hands there are more than busy over munition work.

When your countrymen get to know what a large field for trade there is now here in Holland, they would come in shoals to take hold of the market. Whenever possible make British manufacturers understand that the man in the street here asks for British ware, instead of German articles. We will help them as much as possible in so far as concerns the gas industry and its appliances.

For instance, as to gas-fires. In our show-rooms we push English fires instead of the German types; and we cannot get enough of them to supply the demand. Make your British firms all of them understand that we wish to co-operate in every possible way in order to promote the beautiful system of heating with modern British gas-fires.

Hollander.

Nov. 6, 1915.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Lighting Regulations, London.

In the House of Commons last Tuesday, Mr. Hugh Law asked the Secretary of State for the Home Department whether, having regard to the regulations now enforced in the matter of domestic lighting, and with a view to diminishing the risk of street accidents and alleviating the gloom of London after nightfall, he was now prepared to sanction an increase of lighting by public authorities?

Sir J. Simon, in reply, stated that the lighting of London is regulated in accordance with advice given by those responsible for the defence of London from air raids; and while full consideration was given to the desirability of maintaining reasonable lighting, he could not disregard the advice under which he was acting. The matter was receiving close attention, and if any relaxation was found practicable it would be given effect to without delay.

Colonel Edmund Eaton.

Mr. MacCallum Scott asked the Under-Secretary for War whether he had seen the observations made by Judge Mackarness on the conduct of Colonel Edmund Eaton in a recent case heard at Hayward's Heath County Court (*ante*, p. 216) ; and whether any action had been taken in respect of this officer ?

Mr. Tennant : My attention has been called to the observations made by the learned Judge referred to. I may state that the Judge himself wrote to the War Office. The case of Colonel Eaton is now under the consideration of the Army Council.

The Recruiting of Skilled Employees.

Sir G. Scott Robertson on Wednesday asked the Under-Secretary of State for War (1) whether recruiting officers were still in possession of orders directing them not to enlist skilled employees of electric power corporations, tramways, &c., without the written consent of the company, or had those orders been modified or withdrawn since July 12 ; and (2) whether he was aware that to ensure the carriage, to and from their homes, of workmen engaged in the manufacture of munitions of war at Bradford there must be retained in the tramway department of the Corporation an irreducible minimum of skilled artizans of military age after every possible substitution of older and less skilled men for those younger and more efficient had been made, and after reductions had been carried out to the limits even of wartime possibility. Could he now state whether these remaining necessary men will be granted an official badge to show they have been refused enlistment in the Army by the recruiting authorities on the ground of public expediency ?

Mr. Tennant : The attestation of all such men as those mentioned has been authorized by the War Office. When attested, they will be placed in their proper group, and will not be called up unless and until, when their time comes, they are found to be no longer indispensable to their employers ; but, in the meantime, the employers are required to take every step as far as possible to provide temporary substitutes for these men from men medically unfit, men too old for enlistment, or women. This arrangement has been agreed to by the various departments concerned.

Sir G. Scott Robertson : Is a special badge to be given to those men who have been recruited, but who, for the reasons stated, have not been enlisted ?

Mr. Tennant : Yes, Lord Derby has in contemplation the giving of an armlet.

On Thursday, Mr. Samuel Roberts asked the Minister of Munitions whether he had power to prevent men engaged on electric power stations which supply munition works with current from being recruited ; and, if not, would he take immediate steps to obtain wider powers for this and other undertakings essential to munition work being carried on ?

Colonel Arthur Lee—the Parliamentary (Military) Secretary to the Munitions Department—replied that the Minister of Munitions has power to issue badges to indispensable men engaged in electrical power stations supplying current for war purposes. Badges had been issued in such cases wherever application had been made.

Municipal Expenditure.

On Thursday, the Secretary of Scotland was asked by Mr. Watt whether a circular was issued in August by the Local Government Board of Scotland advising local authorities to curtail expenditure on parks, recreation grounds, libraries, street lighting, and other objects, with the object of reducing local rates in view of the increased Imperial taxation due to the war. If so, would he say how many local authorities responded to the circular by reduction of their rates, and give the names of the local authorities, if any, that had increased their local rates, notwithstanding the appeal of his department ?

In reply, Mr. McKinnon Wood said : Following an earlier circular dealing with another aspect of the same subject, the circular referred to was issued in August to some 2000 local authorities throughout Scotland rating for all kinds of local purposes, including those specified by Mr. Watt. A detailed reply on the points suggested could not be given without the issue of a further circular asking for specific information, and the time for such action had not yet arrived.

LEGAL INTELLIGENCE.

PUBLIC AUTHORITIES PROTECTION ACT.

Accident while Delivering a Load of Coke.

The House of Lords last Friday gave judgment in the case of *Myers v. Bradford Corporation*—the plaintiff being successful. The earlier arguments before the Courts were reported in the "Journal" for Dec. 16, 1913, and Nov. 10, 1914.

Mr. Myers ordered from the Corporation a ton of coke, and on the same day they sent a cart in charge of a carter in their employ to his premises with a view to delivering it. The man backed the cart on to the pavement, and tipped it in order to send the coke through the coal-hole in the pavement ; but he so negligently managed it as to shoot the coke through a large plate-glass window. Mr. Myers did not commence an action to recover damages until May 7, 1913—more than six months after the accident ; and the Corporation set up the statutory defence that the action was barred by the Public Authorities Protection Act, 1863, which provides that such an action must be begun within six months. The action came before the County Court Judge and a Jury in the Bradford County Court. The Jury returned a verdict for Mr. Myers for £17 2s. damages ; but the Judge held that the case was expressly covered by the Act, and gave judgment for the Corporation. Upon an appeal being taken to a Divisional Court the learned Judges differed in opinion. Mr. Justice Bray was of opinion that the action was barred by the Act ; while Mr. Justice Lush held that, in the circumstances, the Act did not apply. In the result the appeal of the respondent was dismissed. Against this decision Mr. Myers appealed to the Court of Appeal, with the result that it was directed that judgment be entered in his favour for the damages found by the Jury at the trial. The Court of Appeal unanimously held that, in the circumstances of the case, the Public Authorities Protection Act had no application ; so the Corporation appealed to the House of Lords, where arguments were heard last July by the Lord Chancellor and Lords Haldane, Dunedin, Atkinson, and Shaw, when judgment was reserved. The sole question involved in the appeal to the House of Lords was whether or not the action was barred by the Act. On this point the respondent contended that in this transaction the Corporation were not acting in their capacity as a municipality, but as traders, and were not entitled to claim the protection of the Act.

The Lord Chancellor, having dealt with the facts of the case and with the Bradford Corporation Acts, said : It is not because the act out of which an action arises is within the power that a public authority enjoys the benefit of the Statute. It is because the act is one which is either an act in the direct execution of a Statute or in the discharge of a public duty or the exercise of a public authority. I regard these latter words as meaning a duty owed to the public or an authority exercised impartially with regard to all the public. It assumes that there is a duty and an authority which is not a public one, and that in the exercise or discharge of such a duty this protection does not apply. This distinction is well illustrated by the present case. It may be conceded that the Local Authority were bound properly to dispose of their residual products ; but there was no obligation upon them to dispose by sale, though this was the most obvious and ordinary way. Still less was there any duty to dispose of them to the respondent. No member of the public could have complained if the respondent had not been supplied, nor had any member of the public the right to require the Local Authority to contract with him. The act complained of arose because one of the servants of the appellants, acting in the course of an errand on which they had power to send him, but on which they were not bound in the execution of any Act or in the discharge of any public duty or authority to send him in breach of his common law duty to his fellow-citizens, caused damage by his personal negligence. In my opinion, an action for such negligence is not within the class of action contemplated by the Statute.

Lords Haldane, Dunedin, Atkinson, and Shaw concurred ; and the appeal of the Corporation was dismissed, with costs.

SEQUEL TO A GAS-STOKER'S STRIKE.

The Stoppage of a Supply.

Sheriff Lee, at Airdrie, has now given his decision in the action, raised in the Small Debt Court, by the Coatbridge Picture House, Limited, against the Coatbridge Gas Company, which was recently debated before him [see *ante*, p. 268]. The pursuers claimed £50, restricted to £20, in respect of loss and damage sustained by them on or about June 5, 1915, in consequence of the defenders' failure to supply them with gas, as they undertook to do, through their Manager (Mr. Thomas Wilson), whereby pursuers were obliged to refund to their patrons the price of their admission. The defence was that the action was incompetent. The Sheriff, after avizandum, has now dismissed the action, with expenses to the Gas Company.

In the course of his judgment, the Sheriff said the Gas Company was incorporated by a Private Act, which incorporates the Gas-Works Clauses Acts of 1847 and 1871. The pursuers based their claim, first, on the statutory obligation to supply, which they maintained established an ordinary contractual relation between the Gas Company and those whom they supplied ; and, secondly, on a special undertaking alleged to have been given by the Company through their Manager. There was a strike of the employees of the Gas Company ; and it was the failure of negotiations for the settlement of the dispute which led to a stoppage of the gas supply for a few hours. The Gas Company had been in existence for a great number of years ; and there were similar companies all over the three kingdoms. Disappointments and losses through failure to supply must therefore have been fairly frequent ; and it was probably enough for the disposal of this claim in the Small Debt Court that the pursuers could point to no precedent. The Small Debt Court was not the proper place in which to raise important questions of right by claims which, for the greater part of a century, had been tacitly accepted to be untenable. But the case might be disposed of on other grounds. Though there was not, he thought, any Scotch authority, the English Courts had decided against the pursuers' contention. In *Atkinson v. Newcastle Water-Works Company* [2 Ex. Div., 441], the question raised was not quite the same as in this case, because the breach founded on was one of a statutory duty to provide a public supply of water. But much that was said in the case was equally applicable to an action for failure of the duty to supply to an individual in return for private payment ; and the matter was important as throwing doubt on the broad general proposition which appeared to have been laid down in *Couch v. Steel* [3 Ell. and B., 402], that "wherever a statutory duty is created, any person who can show that he has sustained injuries from the non-performance of that duty can bring an action for damages against the person on whom the duty is imposed." Lord Cockburn said : "The Act does not give by implication to persons injured by breach of duties thereby imposed any remedy over and above those which it gives in express terms. If, therefore, any person is injured by a breach of such duty, he must have recourse to the statutory remedy, and cannot maintain an action for damages." Following this was the case of *Clegg, Parkinson, and Co. v. Earby and Thornton Gas Company* [1896, 1 Q.B.D., 592], which exactly disposed of pursuers' claim. It was there held that an action would not lie against a gas company, to which the provisions of the Gas-Works Clauses Act, 1871, applied, for damages sustained by a consumer by reason of the failure to give him a supply of gas ; and that the consumer's only remedy was to proceed for penalties under section 36 of the Act. *Morris and Bastert v. Loughborough Corporation* [1908, 1 K.B.D., 205] was in no way inconsistent with the cases to which he had referred. There the corporation, apart from their duty to supply their own public, had power to contract for the supply of electricity with outside consumers. The plaintiffs, who were not entitled under the Act to require a supply, made an agreement with the corporation for one. It was held that an action for damages lay for breach of the agreement to supply; there being no clear words in the Statute confirming the remedy of the plaintiffs to proceedings to recover the penalty under the penalty clause of the Act. But Lord Alverstone clearly suggested that the decision would have been the other way if it could have been held that the agreement made was subject to the provisions of the penalty clause. He (the Sheriff) did not think the additional agreement of a special undertaking by the Manager affected the relevancy of the present claim. The duty to supply was already absolute under the provisions of the Gas Act; and no undertaking could enlarge it. If the pursuers could aver that the undertaking by the Manager was the foundation of their right to a supply, they might be able to bring this case within the principle of *Morris and Bastert*. But they could not aver this. They obtained their supply as one of the public whom the Company were bound to supply under compulsitor of the penalties that were provided for by the Act.

The action was dismissed, with expenses.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Friday, Nov. 12.

(*Before Mr. Justice* LAWRENCE *and a Common Jury.*)

Leigh v. Tottenham District Light, Heat, and Power Company.

In this case Walter Leigh, a nurseryman carrying on business at Lower Edmonton, claimed damages against defendants, who formerly carried on business as the Tottenham and Edmonton Gas Company, for alleged breach of contract for the supply of coke. By a contract in writing dated Dec. 18 last, Mr. A. E. Broadberry, acting on behalf and with the authority of the defendants, agreed with the plaintiff to sell him 100 tons of unbroken coke at 13s. 4d. per ton delivered between Dec. 19, 1914, and Dec. 16, 1915. It was said to be an implied term of the contract that defendants should supply the coke in such reasonable quantities, and at such reasonable time within the period, as the plaintiff might require; and that if defendants were at any time unable to supply coke, they should give reasonable notice thereof. The coke was required by the plaintiff for the purpose of heating his greenhouses. It was alleged that in breach of contract defendants on Feb. 10 wrongfully and without due notice refused to continue the supply of coke, with the result that the plants in the greenhouse were killed by the cold. Defendants admitted the contract, but said it was an express condition thereof that their liability to deliver coke was subject to their power to suspend the contract if they required the coke for the purpose of gas manufacture. Defendants did require all the coke which they produced for the purpose of gas manufacture; and on Feb. 10 they gave notice to plaintiff that they were unable to continue the supply of coke under the contract.

Mr. PATRICK HASTINGS appeared for the plaintiff, Mr. NEILSON for the defendants.

Evidence was given on behalf of the plaintiff that in February last defendants were selling large quantities of coke at a higher price than 13s. 4d. per ton; and it was suggested that putting an end to the contract was done for the purpose of earning extra profit. This suggestion was flatly contradicted by defendants. Plaintiff estimated his loss at £534—that being the value of 6800 plants which were destroyed.

His LORDSHIP ruled that the measure of damage for any breach of the contract must be the difference between 13s. 4d. and the price a person would have to pay to get coke in the market. Defendants were selling coke in February at £1 and £1 1s. 8d.; and if plaintiff had paid £1 1s. 8d. per ton defendants would have delivered coke to him.

In the result the Jury found for the plaintiff, assessing the damages at £200.

His LORDSHIP granted a stay of execution on the usual terms.

WORKMEN'S COMPENSATION ACTS APPEAL.

On Wednesday last the case of *Strange v. Davis Gas-Stove Company* came before the MASTER OF THE ROLLS and Lords Justices BANKES and WARRINGTON, by way of appeal on part of the plaintiff from the award of the County Court Judge at Luton. At the outset,

Mr. SHAKESPEAR, for the respondents, took the preliminary objection that the appeal would not lie, as the workman in whose favour the award was made had enforced the award by accepting the amount awarded. Counsel said the claim was brought in the County Court by the mother, as a dependant of her son, who was killed while in respondents' employ. The employers denied any liability, but paid into Court £60, which they said was enough to answer any claim. The County Court Judge made an award for £100, with costs; and, on the £40 and the amount of the taxed costs being paid into Court, applicant took it out, and then served notice of appeal to increase the amount. The Court had already decided, in *Johnson v. Newton Fire Extinguisher Company* and *Jones v. Winder*, that in such circumstances an appeal could not be brought.

Mr. LORT WILLIAMS, for the appellant, argued that the present case was distinguishable from those relied upon, as the facts were quite different. He was not seeking to quarrel with the award; all he said was that the learned Judge had awarded less than he was bound to do by the schedule.

Lord Justice BANKES: You cannot approbate and reprobate. If you are not quarrelling with the award, why are you appealing?

Mr. LORT WILLIAMS: Because the learned Judge has done something which, under the Act, he has no power to do. We accept the award so far as it goes, but the amount is not enough.

The Court upheld the objection, and the appeal was dismissed with costs.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary Meeting of the Association was held last Thursday, at the Cannon Street Hotel, E.C.—Sir CHARLES J. JESSEL, Bart., in the chair.

The SECRETARY (Mr. R. W. Wilson) read the notice convening the meeting; and then the Auditors' certificate for the half year ending June 30, 1914.

On the motion of the CHAIRMAN, the report and accounts for the half-year to June 30, 1914, were taken as read.

DIRECTORIAL CHANGES AND ABSENTEES.

The CHAIRMAN: I now beg to move—"That the report of the Directors upon the affairs of the Association for the half year ending June 30, 1914, which has been taken as read, be received, adopted, and entered upon the minutes." Ladies and Gentlemen, I have to commence what I have to say to you by referring to the effect of changes on the Board of Directors. Shortly after I had the pleasure of meeting you last May, our esteemed colleague Sir Chandos Leigh passed away. He had been a Director ever since Nov. 16, 1890; and had therefore been on the Board for nearly a quarter of a century. A great cricketer, a fine judge of horses, and a good rider, he was an example of a cultivated sportsman such as one does not often meet with nowadays; and we shall long mourn the absence of his genial presence, and his fund of anecdote and story. I am sure that, though many of you have your own sorrows and your own tragedies, your hearts will go out in sympathy to Lady Leigh, who, in the course of but a few months, has lost her husband and both her sons, who have been killed at the front. [Assent.] In the place of Sir Chandos Leigh, we have elected Lord Gorell of Brampton. He is, as I daresay you know, the son of a distinguished lawyer. He has already made a mark for himself; and, being a young man, he is naturally serving his country at the present moment; and, though we had hoped up to the last, as he was coming home shortly for a week's leave from the front, that he would be able to attend here to-day, I need not apologize for his absence, for it is one that you will think is both natural and proper. I am certain that, under happier conditions, we shall have the advantage of the abilities with which he is certainly endowed. Mr. Arthur Lucas, the Deputy-Chairman, is also an absentee to-day. I am sorry to say that he recently had to undergo a very severe operation. But I am glad to say his recovery has been most rapid. I am going myself to see him to-morrow; and I hope he will be back shortly to assist us with his ripe experience of the affairs of the Association. Colonel Le Roy-Lewis has been appointed an extra military attaché at Paris; and his intimate acquaintance with the French language, and his undoubted natural abilities, render him of most valuable assistance to his country. Mr. Palmer who, when I last addressed you, was a sergeant in the Royal Engineers, has now received his commission; but he is still busy on regimental work, and so unable to be here to-day.

THE ACCOUNTS TO JUNE, 1914—TECHNICALLY ILLEGAL DISTRIBUTIONS.

I will now turn to the question of the report and the balance-sheet which you have had circulated among you. I do not think I will waste your time very much on the question of this belated report. It is somewhat ancient history now, and has only an academic interest. But I should like to say a few words with reference to the balance-sheet which accompanies the report. I told you in November last year, as a justification for the distribution which I then proposed, that our monthly returns had shown that the business up to June 30 last year was quite as good as it was in the corresponding six months of 1913. I said nothing about our profits, because it was impossible to speak of them. Again last May, I proposed a further similar distribution. I then said we were earning fairly normal profits up to June, 1914; and, under normal circumstances, 4½ per cent. would have been paid as usual last November. We were almost certain it had been earned; and we have now information which makes it perfectly certain. However, we had no balance-sheet signed by the Auditor; and therefore I could not move for the usual dividend to be paid. Between June 30, 1914, and the time of the declaration of war, of course the accounts of some of our stations had already been received; and as is indicated by the fact that we have now prepared a regular balance-sheet and submitted the same to our Auditors, and it has been properly audited, we eventually received the fully vouched-for accounts from Berlin, Hanover, and our Bohemian stations, which had been previously missing. The decrease in the profit of £67,349 is fully accounted for by the increase of 1s. 10¾d, per ton in the cost of coal (which represents a sum of £46,000), and by the decrease in the value of coke and ammonia products. The net profit of £219,189, with the help of £3171 brought forward from the previous half year, justified the Directors in having made, and the proprietors in having accepted, the proposals for two distributions of 2¼ per cent. in November, 1914, and in May, 1915, respectively. After making these distributions, there remained a credit balance of £10,265. The reason why I wish to emphasize this point is that, although we proposed that this distribution should be made, without having a scheme prepared as provided by section 120 of the Companies' Clauses Consolidation Act, 1845, the balance-sheet proves that our action was one of intelligent anticipation, and that nothing has been distributed except profits—not only properly and fairly earned, but profits which were actually in our possession.

AN ILLEGALITY AND A BILL IN PARLIAMENT.

Well it seems that, however that might have been the case, these distributions were irregular, and not in conformity with the clause to which I have referred. The proper course would have been for you to have gone without these two dividends during last year, and have waited until to-day when, on the strength of the scheme which you have all had, we could have made a proper distribution of 4½ per cent. We thought, however, you would rather have your money at once, instead of waiting for this blessed day, and we could not really tell vhen the day would come. We have undoubtedly committed an llegality of a strictly technical character; and we are advised by our egal counsellors that this can only be atoned for and washed out by ın Act of Parliament. We intend to give notice of the promotion of Bill in Parliament within a few days' time; and we shall take advanage of this to make clear and revise some of the clauses in our various icts which are not sufficiently explicit. But, of course, no action n this matter will be taken by you to-day. You will all be called ogether in due course for the statutory or Wharncliffe meeting, when shall have the pleasure of explaining to you at length the various lauses of the Bill. The measure is now receiving the anxious conideration of your Board. Now, of course, for the past two half years hat have elapsed since the period with which the balance-sheet deals, ve have no idea what profits have been earned; and, as I warned you n the last occasion, no further distribution can be made until after the var. Then we may be in possession of our own funds and moneys vhich are at present locked-up abroad.

THE PAYMENT OF FURTHER DIVIDENDS.

daresay I may anticipate questions that will be asked me, and I think or many reasons it may be advisable if the shareholders were put in ossession of some correspondence which took place between an minent firm of stockbrokers and myself on this point. I think the etters bring out fairly clearly the position of affairs, and every proprietor ought to have the opportunity of reading them. The first is a etter from Messrs. Woolston and Co. to me, dated Oct. 4, 1915:

> We are interested on behalf of a large number of holders of the capital stock of your Company; and, though we are aware that the Chairman at the last meeting stated that it was not the intention of the Company to pay any further dividends until the end of the war, we have received so many inquiries that we hope the Board will see their way to reconsider the matter.
>
> The report shows that considerable reserves have been set aside in past years out of profits, which, in the ordinary course, would, we suppose, have been available for a dividend on the capital stock had not the Company wisely built-up reserves for equalization of dividends, &c, as shown by the balance-sheet.
>
> If it is possible to come to some arrangement whereby for the next two years a small dividend of (say) 3 per cent. could be paid to the stockholders, it would be a great help, and enable many small holders to tide over a difficult time.
>
> If any excuse is necessary for troubling you, it is that having for many years advised your Company's stock to investors, we know that the passing of the dividend would in many instances cause serious inconvenience.

'Hear, hear."] I quite understand your sympathy with that letter—mpathy which the Board fully share. I will now read you a copy a letter that I wrote in reply dated Oct. 5 last:

> I am in due receipt of your letter of yesterday's date.
>
> The payment of a dividend would be illegal without a scheme showing profits, which it is impossible to prepare [see clause 120 Companies Clauses Consolidation Act, 1845].
>
> I would point out to you, as I have done to others, that since the war, with practically no receipts from abroad, we have paid away well over £300,000 in dividends, interest on debenture stock, and income-tax, payments which have seriously depleted our available cash resources.

wish for a moment to refer to income-tax, because it is rather a rious item. I may say that, during the last week or two, we have een served with an assessment of the small sum of £100,000, which e authorities thought we ought to pay them. I need not tell you at we have appealed against such an assessment; and I hope and ust we shall get off altogether. [Continuing reading]

> I would also remind you that our principal assets are in the hands, and under the control, of the enemy; and, while this is the case, it would be impossible to say that our capital is intact, and therefore no distribution could be made from any "fund," even if we had the means to do so.
>
> In these circumstances, I hope you will think I was well advised in warning the shareholders not to expect further payments till the war was over.

lessrs. Woolston and Co. replied to me in a letter dated Oct. 6.

> We thank you for your letter received this morning, and for the information you so kindly give us with regard to Imperial Continental Gas.
>
> We are pleased to have this information, as it will enable us to explain the position in which the Company is placed more precisely when clients inquire as to the prospects of a dividend.

INFORMATION FROM THE STATIONS.

Vell, I think I have dealt with that matter as fully as is necessary. robably the proprietors would like to know something about what formation we have with respect to those stations from which we e now cut off. But direct communication, as I have said, has been evered with our stations in Germany, Austria, and Belgium; but formation of an interesting, and, I may say gladly, reassuring, nature as reached the Board by reason of the occasional visits paid by the ecretary to Holland, where he has met Messrs. Joerger and Körting, Berlin. I will just tell you briefly what Mr. Körting recently reorted. He says our coal supply continues to be very satisfactory. oke is finding a ready market. Suitable arrangements have been ade with regard to labour on the works; and we can look forward the coming winter with some confidence. Then he shows ow an ill-wind sometimes blows some good, by stating that the utting-off of the supply of petroleum is having an extremely avourable effect on German lighting interests by residents taking as and electricity. The gas consumption in July last was 4 per cent. igher than in July, 1914; and the consumption in August gave very indication of passing that of 1914. He then also told us what as very agreeable information for us to have, that his second in com and. Mr. Thompson (who is an Englishman, and who was interned) ad been released, and had resumed his duties on the works. I used e word "reassuring" with respect to this information, because it shows that at all events, up to the date of this information, our business was working in an absolutely normal manner, under the management of our own officers. Of course, our finances are strictly under the supervisors who have been appointed by the German Government. When we last heard as to our funds at Berlin, we considered them to be very considerable; and they looked as if they were still going to grow. But we shall not have the benefit of these until peace comes along. Berlin can safely be left to finance itself and the other stations under the control of the enemy. With regard to Belgium, there is nothing for me to say since our last meeting. In France, the town of Nancy, in which we have such considerable interests, has been visited, on more than one occasion, by bombs from German aircraft; but no damage of any considerable nature was done to any of our property. Our chief anxiety with respect to France has been the furnshing of coal to the Compagnie Continentale. But luckily the representatives of that Company have been able to draw upon the experience of Mr. Wilson in dealing with this complicated question. With freights from the North to Rouen at 21s. per ton, and coal costing 19s. per ton before it is handled at all, it runs us in to about £2 per ton at Rouen. But what it costs by the time it reaches Nancy, which is at the extreme east of France, I must leave to your own imagination. You may, however, be sure that Mr. Wilson and the London office are doing their best to assist our French *confrères* over their difficulties in this matter. I do not think I need trouble you any more with respect to these accounts.

Mr. H. BIRCHENOUGH, C.M.G., formally seconded the motion.

REASONS FOR CONFIDENCE.

Sir PERCEVAL LAURENCE said there were one or two observations which, with the indulgence of the meeting, he should like to be permitted to make. They would be of a general character, because the report and accounts, in the exceptional circumstances, did not suggest much in the way of either discussion or criticism. He thought the information was given at the last meeting (the Chairman would correct him if he was wrong) that the number of transfers of shares in the Association since the outbreak of hostilities had been very small. [The CHAIRMAN: That is so.] He was rather under the impression that the state of things in this respect had been similar since then. [The CHAIRMAN: Yes.] Now he thought there must be some cases (such as those hinted at in the letter from the stockbrokers which the Chairman had read) of executors and others where realizations might have been inevitable. But he could not help thinking that the general feeling of the proprietors was that the Association, owing to sound management in the past, still occupied a strong financial position; and so it would be a very great pity if any proprietors, who were not forced to do so, were induced by the anxieties and vicissitudes of the hour to sacrifice their holdings. [Hear, hear.] And he was fortified in this view by two considerations. Of course, the Association had been extremely unfortunate in the circumstances. He understood that practically all their property, their plant, and the sphere of their operations were either in enemy territory, or in territory which (he omitted some of the small places in France), since the early days of the war, had been in the occupation of the enemy. He daresay some of the proprietors had seen an article—an interesting, and it appeared to him to be a well-informed, article—which was headed "German War Legislation, as to Treatment of Enemy Property," and which appeared in the current number of the "Economist." He thought the proprietors would have some interest and satisfaction in reading the article. Now he understood, so far as the property of alien enemies resident abroad, and situated in the United Kingdom was concerned, that it was being administered by the Public Trustee. He believed, too, it was under the competent personal supervision of Sir William Plender. Similarly, under the ordinance of the German Federal Council, property of alien enemies in Germany was now under German control. He understood from the Chairman that, so far as Berlin was concerned, the control was merely of a financial, and not apparently of an administrative, character. He gathered there had been no disposition whatever on the part of the German authorities (he took it it was the same in Austria) to confiscate property. When the proprietors reflected that the amount, the bulk, and value of enemy property situated in the United Kingdom must far exceed the amount of British property situated in Germany, he did not think they need go very far to surmise the reasons for such forbearance. Passing from that to property situated in the countries of our Allies which at present were under the grip of the foe, this would not be the occasion, and it would be wholly imprudent, for him to attempt to weary the proprietors with anything like a discussion of what was known in his profession, and the Chairman's profession, as the law of comity. But he well understood that this cataclysm was not going to last for ever, and when they arrived at a tolerable issue, one of the essential and primary conditions of such issue would be compensation in respect of any damage which occupation by the enemy involved. If he was not wholly wrong with regard to these points, then there were reasons why they should not despond in regard to the future. These were reasons why all the proprietors of this important Association should endeavour to possess their souls in patience; and though it was impossible to forecast the future and anticipate the march of events, they might hope that the Association had before it a future no less satisfactory and no less creditable than had been the past.

Mr. FYFIELD said he should like some information as to how it was that the prime cost of coal was so heavy, and the amount obtained for the bye-products had fallen off in such marked degree. Some explanation should also be given as to the loans to subsidiary companies. This showed a very heavy increase.

Mr. BISGOOD asked whether the funds in Germany were on credit or in German war loan.

The CHAIRMAN said he could answer the last question. The latest information was that a certain amount of money both at Berlin and Hanover had been taken by the Government controllers, and invested in their war loan.

Mr. BISGOOD: I take it, it is a large sum, Sir?

The CHAIRMAN said that it was not. It was about 3 million marks; and if they took 20 marks to the sovereign, it came to approximately £150,000, which was not a serious amount.

Mr. BISGOOD: They will, I suppose, be able to meet their war loan?

The Chairman said he could not tell what the present situation was. The money was in the first two loans—not in the new loan.

Sir Perceval Laurence said he saw Consols were put down at 80. Had they been converted into British war loan?

The Chairman replied that the Board had a grand debate on the question of the conversion of the Consols; but some of his colleagues were of one view, and some of another; and, like true Britons, they arrived at a compromise. Some of the Consols were converted; and some were not. The present position was that they had £300,000 out of £500,000 of Consols unconverted.

The motion was unanimously carried.

Sale of the Frankfort Shares—A Big Transaction.

The Chairman: Now, Ladies and Gentlemen, I wish to separately address you, and make a motion with reference to Frankfort. This time last year, curiously enough, I forgot to mention Frankfort; and it was only at the close of the meeting that a proprietor came up, and drew my attention to the fact. On this occasion, I think Frankfort must loom rather largely in my remarks. The history of how the Association became the predominant partner in the Frankfort Gas Company was told to the proprietors by Mr. Palmer, my predecessor in the chair, in November, 1909. He told the proprietors then how, in order to save the interests of the Association, the capital of the Frankfort Gas Company was enlarged to embrace the station and undertaking of the Association, and to enable the Corporation to become partners in the Gas Company by subscribing for a large block of shares. In the Frankfort Gas Company, we held the controlling interest, and nominated a majority of the Board. At the outbreak of war, the Association held 7705 shares out of 13,600 shares. The Corporation owned 3157 shares, and the general public 2758 shares. An important condition of the new contract made between the Corporation and the Company was that the Corporation should have the right, under certain specified terms, to purchase the whole of the concern on Oct. 1, 1929. Now bearing this in mind, I want to tell you that the Company working in the way that it did, was a most successful company and regularly paid dividends of 10 per cent. In February last, the Board received a communication to the effect that the Frankfort Corporation wished to buy the whole of the shares of the Association at the price of 1700 marks—that was to say, £85 (I am treating the pound as being worth 20 marks)—for each share of £50 nominal. And with this we were to receive the usual dividend of 10 per cent. for the year ending April, 1915. The proposal was considered by the Board; and we thought it right to send, in reply, a resolution to the effect that the Board were absolutely precluded by legislation from entertaining the proposal. The next month—March—the Secretary received permission from the Foreign Office to go to Amsterdam to meet our representatives from Berlin. At this conference, which took place between the Secretary and these gentlemen, the sale of the Association's Frankfort shares was again raised. On his return, the Secretary submitted to us a report on the question; and, in consequence of this report, the Board came to the conclusion that it would be desirable to sell in the interests of the Association. We sent a copy of the Secretary's report and of the resolution of the Board to the Foreign Office; and they referred the whole question to Sir Arthur Thring, the Parliamentary Counsel. We then received from Sir Arthur permission to negotiate with the town authorities of Frankfort on terms laid down by him. In June, Mr. Wilson again proceeded to Amsterdam; and the final result was an agreement between the Corporation of Frankfort and the Association, by its representatives in Germany, which has received the sanction of the Parliamentary Counsel. I do not think I can do better than read to you the principal correspondence with respect to this, which will explain everything.

After doing so, the Chairman resumed his speech: From it you will see that, for the 7705 shares, the Association is to receive a price of £99 per share, without taking exchange into consideration, or £762,795. But this sum includes the agreed amount of £11,887 compensation to the Directors for loss of office. Secondly, the dividend for the year 1915, amounting to £38,525; and the balance of the loan £140,000, so that altogether, at the conclusion of peace—taking again as I warned you (because I am not going to make any prophecy) the value of the mark as 20 to the pound—there will be a total sum to be paid to us of £941,320, *plus* interest on the purchase-price of the shares, and of the balance of the loan. I may remark that the value of the shares on the books of the Association stands at £460,650 5s. 6d.

PIONEERS OF GAS SUPPLY IN GERMANY.

I have, in thus treating of the history of the Frankfort Gas Company to remind you that a very long, and, I may say, most agreeable connection hitherto, comes to an end. I dare say those of you who are acquainted with the history of the Association will remember we were the pioneers of the gas industry in Germany; we were the first that ever burst upon that scene. We began at Hanover in 1825; and we went to Berlin in 1826. Our connection with Frankfort is as old as 1829.

GOOD RELATIONS AND GOOD-BYE.

I do not think I ought to sit down without referring in some way to the relations that had existed up to the very end with our late colleagues of the Frankfort Board; and I must in that regard just trouble you for one moment more by reading a short extract from the speech of Mr. Scharff, the Chairman of the Company, at a meeting held on Sept. 10 last. He said:

> In an old song, the passage occurs: "When friends part, they say *au revoir*." In this case, this does not apply. We shall never see these gentlemen, with whom we got on so well, among us again. I find it to a certain extent difficult, in view of the war which we are now waging with England, to say a good word for an Englishman; but in this case I make an exception. These gentlemen have never done us any harm, They have always been pleasant to us; and they have achieved much in the sphere of the gas industry. Although the German gas industry is at present quite up to date, it must nevertheless be recognized that

VENTILATION.

Interesting Comparison—the Result of Actual Tests.

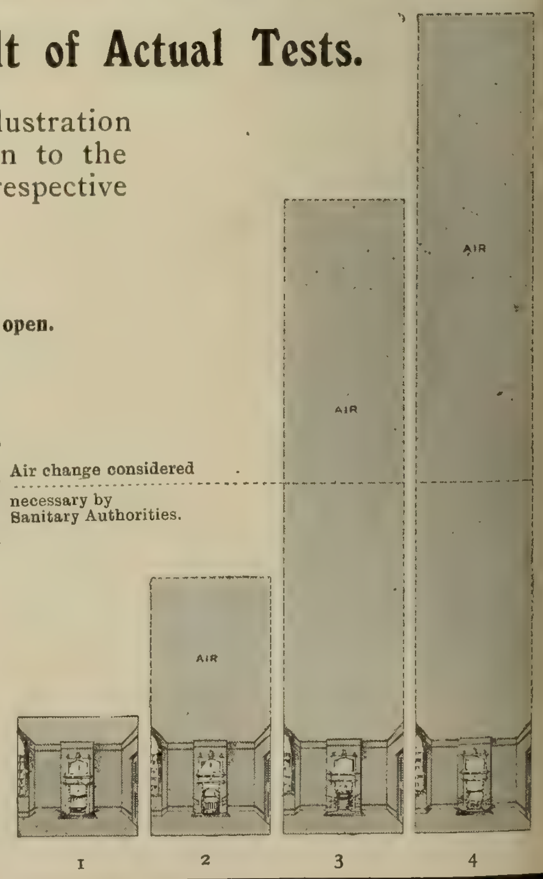
The heights of the columns in the accompanying illustration show the comparative volumes of air (in proportion to the size of room) which are carried off by means of the respective heating agencies.

1. Room to be heated.
2. Air-change with ordinary gas fire.
3. Air-Change with "Injector-Ventilating" Gas Fire, with regulator open.
4. Air-change with coal fire—excess tending to draught.

It will be seen how the amount of ventilation provided by the "Injector-Ventilating" Fires is substantially above the figure regarded as a suitable minimum by Sanitary Authorities generally. **This figure is indicated by the dotted line crossing the diagram.**

NO NEW DESIGNS *are necessitated for embodying this and our other 1915 perfectionments—these are all included in the entire range of our existing standard patterns, from the cheap 10-in. Fire of 25s. List price upwards.*

John Wright & Co. Essex Works, **Birmingham.**



> gas is used far more in England than here; and it is just in this respect that these gentlemen always gave us such good advice. I would also remind you of the satisfactory condition of the Bockenheim works, and of the erection of the successful new works at the Osthafen, in which all the gentlemen took a lively interest. You will doubtless join with me in wishing them a hearty farewell, and in thanking them for all they have done for the gas industry in Frankfort. Owing to existing circumstances, I am not at present in a position to express our thanks to these gentlemen—perhaps Mr. Joerger will be able to do so.

I have read these remarks *in extenso*, because I should like to say, on behalf of myself and my colleagues of the Frankfort Board, that I very heartily reciprocate the feelings which prompted Mr. Scharff to make them. We had nothing but kindness and courtesy from the members of the Frankfort Board; and, whatever we may think of the Germans and German doings, I can say candidly "Good-bye" to those former colleagues. You have heard now all I have to say of Frankfort; and therefore, in order to put all I have said into order, I wish to ask for your formal approval of what the Board have done in disposing of these shares. I will move—"That the action of the Board of Directors in concluding a contract with the Municipality of Frankfort-on-Main for the sale of the 7705 shares held by the Association in the Frankfort Gas Company be, and is hereby, approved."

Mr. BIRCHENOUGH, in seconding the motion, said: I think the transaction, as set out by the Chairman, can be recommended for your approval as a satisfactory one.

The motion was unanimously carried.

CHELTENHAM GAS-WORKERS' DISPUTE.

Award in the Men's Favour.

It is understood that Mr. Warrender Mackenzie, K.C., the Arbitrator appointed by the Board of Trade to adjust the difference between the Cheltenham Gas Company and their employees on the question of a war bonus [*ante*, p. 330], has issued his award, and that it is favourable to the men's demands, though they do not receive quite all they asked for.

It will be remembered the men applied for a war bonus of 3s. 6d. per week, on account of the increased prices of commodities. The Arbitrator has awarded them 3s. per week, or 6d. less than they asked for. The increment to the wages will date as and from the first full pay week after Oct. 9, and will continue until the termination of the war and the declaration of peace, after which wages will revert to the normal standard.

As already stated, the Arbitrator was not to decide the question of the recognition of the men's Union. This matter remains to be adjusted between the Company and their employees.

WARRINGTON CORPORATION GAS UNDERTAKING.

Application for a Calorific Standard to be Substituted for Illuminating Power.

At the Warrington Town Hall, on Wednesday last, Mr. A. W. BRIGHTMORE, D.Sc., M.Inst.C.E., an Inspector of the Local Government Board, held an inquiry relating to the application of the Corporation for the issue of a Provisional Order under sections 297 and 303 of the Public Health Act, 1875, to partially repeal, alter, or amend the Warrington Corporation Gas Act, 1877, so as: (1) To provide for the abolition of the standard of illuminating power of gas supplied; and the substitution therefor of a calorific standard; (2) to increase the pressure at which gas is required by the Local Act to be supplied by the Corporation; (3) for the several purposes of the application, or for purposes connected with, incidental to, or consequent upon, those purposes, to make any alterations or amendments of the Local Act as may be necessary or desirable.

STATISTICAL INFORMATION.

The DEPUTY TOWN CLERK (Mr. A. T. Hallaway) said that at the census of 1911 the population of the County Borough of Warrington was 72,178; and the estimated population to-day was 76,000. In 1901 it was 64,242; and at the census of the previous decade, 52,742. The area of the borough was now 3116 acres; and the rateable value of the town to the borough rate was £308,979. The assessable value of the borough to the Improvement Committee was £286,643. The rates in the town were 9s. 4d. in the pound; last year they were 8s.

Regarding the gas undertaking, the information supplied to the Inspector was as given on p. 394.

THE PURPOSE OF THE APPLICATION.

The DEPUTY-TOWN CLERK said the application, as set out in the public notice, was to provide for the abolition of the standard of illuminating power, and also to increase the pressure at which gas was required to be supplied. With regard to the second portion of the application—increasing the pressure of gas—the Corporation did not propose to proceed with this at the present inquiry. It was not covered by the resolution that was passed by the Corporation, and was inserted in the Draft Provisional Order rather under a misapprehension. This had given rise, he had been informed, to the people in their area of supply thinking that the idea, and the result, would be that the Corporation would force the gas through the meters at a much quicker rate; and that certainly they would pay more. He (the speaker) very much regretted that an impression like this should have got abroad. In the Act of 1877 was a clause which was ample for the requirements of the district; and they would accordingly drop the proposal to increase the pressure. When the Warrington Corporation

THE MAIN GAS FIRES.

The ST. NICHOLAS.

The St. Nicholas—

The Gas Fire without a rival.

The new booklet—"Main Reflections"—contains particulars of several new Gas Fires. Copies free on application.

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WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

GAS UNDERTAKING.—*Statement of Debt, 31st October, 1915.*

Purpose.	Authority.	Amount Sanctioned.			Date of Sanction.	Original Period.	Equated Period.	Amount Borrowed.	Amount Repaid.	Amount Outstanding.
		£	s.	d.		Years.	Years.	£	£	£
Purchase of gas undertaking .	Warrington Corporation Gas Act of 1877	176,764	0	0	—	75	56	176,764	66,487	110,276*
Extension . .	Do.	52,350	0	0	—	50	29	52,350	34,826	17,524
Do.	Act of 1879	18,000	0	0	Feb. 16, 1893	24	29	17,481	9,515	7,967
Slot meters . .	Provisional Order, 1896	4,750	0	0	June 17, 1898	10	29	2,064	2,064	—
Extension. . .	Acts 1877 and 1879.	2,000	0	0	Oct. 2, 1895	10	29	2,000	2,000	—
Land	Act of 1911	2,083	16	6	—	48	—	2,084	89	1,995
		255,947	16	6	—	—	—	252,743	114,981	137,762

* Includes annuities of £2531 outstanding, at thirty years' purchase—£75,933.

purchased the undertaking of the then local Gas Company, in 1877, the standard of illuminating power was 16 sperm candles; and there was the usual clause in vogue at those times relating to the question, and Sugg's "London" argand No. 1 was the test-burner employed. But since 1877 there had been very great changes in the usage of gas. At that time gas was largely (if not wholly) consumed for illuminating purposes; and at that time, undoubtedly, the illuminating standard was a proper one. Since then, however, circumstances had greatly changed. To-day they found that the use of gas in commercial businesses had very largely increased—in fact, it equalled, if it did not exceed, the use of gas for illuminating purposes. Warrington he (the Deputy-Town Clerk) emphasized was a town where there were a great number of industries. [Warrington claims to have more industries in its area than any other borough in the United Kingdom—including, as it does, gas-apparatus manufacturers, wire-works establishments, soap-making concerns, india-rubber trades, chemical research organizations, and other up-to-date traders]. In 1877, illumination was practically confined to what were known as flat-flame burners. To-day (except in isolated cases) these burners were quite a thing of the past. When he said "isolated cases" he meant that they might, perhaps, be found in cellars or in lavatories, and other such places where a greater illuminating power was not necessary. For the purpose of giving light, the flat-flame burner was non-existent. Consumers had changed to incandescent mantle burners. As the Inspector would doubtless be aware [Mr. Hallaway proceeded], for the production of light by the incandescent mantle it was unnecessary that there should be any illuminating power in the gas at all. The lighting to-day was produced by the calorific power of the gas, upon the mantle, producing incandescence. Incandescent gas lighting was the modern lighting; and there was no necessity at all for 16-candle power gas in Warrington.

COMMERCIAL USES OF GAS.

Similarly with regard to the commercial use of gas; in this case it was required for heating purposes. It was immaterial to the commercial user whether the candle-power was 20, 10, or 5. In 1914, this principle was generally recognized by Parliament; and also (as the Inspector would remember) in the Bill of that year promoted by the Gas Light and Coke Company. It formed a precedent for a great number of other Bills that session. One he remembered particularly was that of the Liverpool Gas Company. The question was fought out in the House of Commons at very great length; but Parliament, once and for all, definitely decided that the old-fashioned candle-power test was entirely obsolete and unfitted to modern requirements. It placed too great a burden on the manufacture of gas. The Corporation of Warrington had considered this matter for some time; and they had now come to the conclusion that, owing to the increased price of the materials necessary for enriching the gas in order to keep up to the illuminating power standard—an altogether useless standard, if he might say so—it was no longer necessary. The Gas Engineer to the Corporation (Mr. W. S. Haddock) would be called to give evidence in support of the application, and would tell what coal and cannel had been used during the last six years, and the average illuminating power for these years. The time had now come when the Warrington Gas Committee thought it was necessary to approach the Local Government Board to alter their obsolete Act. The proposed new standard would not only be of benefit to the gas manufacturer, but it would be to the benefit of the consumer. The Corporation were, of course, not a philanthropic institution; they found it to their interests to reduce the price of gas as much as possible.

INCREASED DEMAND FOLLOWS A REDUCTION IN PRICE.

They found that an increased demand for gas invariably followed a

Is your Showroom the powerful Gas-selling force it ought to be?

If not, let The Nautilus Co., Ltd. (the only Specialists in Gas Showroom Art), show you how it can be made so. No fees charged for Advice, Plans, Specifications or Estimates.

N.B.—Several important Gas Undertakings have already adopted Nautilus Showroom Schemes.

The Nautilus Co., Ltd.
(*Proprs.: The Davis Gas Stove Co., Ltd.*),
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eduction in price. When the Corporation took over the old Warring-on Gas Company's works in 1877, gas was sold at 4s. per 1000 cubic eet; and previous to the general rise by Lancashire gas undertakings hey were able to supply at 2s. 1d. net. But, owing to the increased rice of materials, and the decreased revenue from residuals, they ound it necessary (in common with other gas manufacturers throughut the kingdom) to increase the price of gas—temporarily, he hoped. fter reiterating the point that the substitution of the calorific standard for that of the illuminating power standard would be of benefit the consumers, the speaker concluded by asking the Chairman of he Stockton Heath Council, and the representative of the Runcorn Rural Council, whether they were present to oppose the scheme.

After a conversational discussion between the Inspector and the Deputy-Town Clerk regarding the original proposals of the Gas Light nd Coke Company as to the standard calorific test, and also a statement that the Northwich Gas Bill of last session fixed the standard at oo B.Th.U., with a 7½ per cent. penalty clause, and so on, according deficiency in relation to test,

Mr. M'INTYRE (Stockton Heath) said he had no instructions from is Council to oppose the application, neither did he see the necessity r wisdom of doing so.

THE GAS ENGINEER'S EVIDENCE.

Mr. *W. S. Haddock* said he had been Gas Engineer to the Corporaion of Warrington for the last 27 years. He had prepared a table howing the average illuminating power, the cubic feet of gas made, nd the coal and the cannel used during the last six years, from which would be seen that the gas made showed a steady increase. On the cquirement by the Corporation of the old Gas Company's undertaking he price of gas was fixed at 3s. 6d. per 1000 cubic feet; from 1903 to 906 it was 2s. 6d.; 1907 to 1908, 2s. 2d.; and 1909 to 1915, 2s. 1d. he price was now—owing to the increased price of materials on ccount of the war—2s. 6d. per 1000 cubic feet net. In order to keep p the standard of 16-candle power prescribed by their Act of 1877, hey had had to use considerable quantities of benzol every year. The ollowing figures showed the main statistics:—

Year.	Average Illuminating Power for the Year.	Coal and Cannel Used (Tons).	Gas Made (Cubic Feet).
1915	16·11	55,463	561,697,000
1914	16·34	51,523	549,553,000
1913	16·49	48,119	515,306,000
1912	16·86	45,566	483,991,000
1911	17·73	42,874	462,662,000
1910	17·87	41,054	447,211,000

The DEPUTY TOWN CLERK (to Mr. Haddock); You have had to ncur considerable expense in your department in order to keep up the statutory power?

Witness: Yes; we have had great expense in enrichment; commodities have become so expensive that it is almost impossible to get hold of them at the present time.

Is it not reasonable for me to suggest that if you had not such a high standard for your illuminating power, the natural corollary would be that gas could be still cheaper?—Yes.

Therefore this clause that you suggest is not only in the interests of the large manufacturers in the town who use gas, but in the interests of the small consumers?—Undoubtedly.

Have you any reason to suppose that any injustice will be done to the gas consumers as a whole by the substitution of a calorific standard for the illuminating power standard?—No. I expect it will be very beneficial to the gas consumers as a whole, as also to the commercial users of gas.

Do you consider that 500 B.Th.U. is a reasonable test to ask for, and that the interests of all the consumers will be amply safeguarded by the proposed test?—I believe so.

The INSPECTOR having asked a question relative to the 500 B.Th.U. standard,

Mr. *Haddock* said this was only a precautionary measure. The calorific standard might go lower when old stocks of coal were being used in times of stress—such as strikes, &c. It was only in abnormal times that the standard might be reduced. Coal deteriorated through being kept in stock.

The DEPUTY TOWN CLERK observed that during the last coal strike the Liverpool Gas Company reduced their gas to 19-candle power, and no one was the wiser. They (Warrington) only desired a margin. They did not propose to regard the standard of 500 B.Th.U. as a maximum. The penalty clause was inserted so that they should not be excessively penalized in times of great stress when no man could carry out his obligations.

The DEPUTY TOWN CLERK (to Mr. Haddock): In general, the gas will be supplied of greater calorific value than 500 B.Th.U.

Witness: Yes. I have not heard of any opposition to the proposals.

The INSPECTOR: Can you give me any idea of what saving will be effected by the alteration of the standard?—Do you mean in the cost per 1000 cubic feet, or the cost per annum? There would be a large saving in the cost of cannel, for which we pay higher prices than for ordinary coal. The saving would be the difference of the price of cannel and the price of ordinary coal—something like (from memory) about 7s. or 8s. a ton on what we are at present using. It had, witness said, for many years past been conceded that gas of a uniform calorific standard was more satisfactory for all ordinary purposes. This was shown by the fact that a large number of gas undertakings had adopted the calorific standard.

The INSPECTOR asked for an abstract of the gas accounts, showing the cost of manufacture, &c., and received an assurance that these would be forwarded in due course.

EX-CHAIRMAN'S TESTIMONY.

Alderman *John Evans*, ex-Chairman of the Gas Committee, said the proposals outlined were in the interests of the borough. The Gas

Write for Particulars and Samples.
THE WELSBACH LIGHT COMPANY, LTD.,
WELSBACH HOUSE, KING'S CROSS, LONDON, W.C.
AND AT BIRMINGHAM, MANCHESTER, LEEDS, STOKE-ON-TRENT, HULL, BRISTOL, AND DUBLIN.
Welsbach Mantles are Upright (C, CX, and Plaissetty) and Inverted.

Committee, before presenting their proposals to the Town Council, very carefully considered all aspects of the question. The more cannel they used for the making of gas, the less benzol they needed; the saving would be in the cost of the benzol and the difference in price between coal and the cannel.

The INSPECTOR: Would it save benzol entirely.

Mr. *Haddock*: Yes.

The INSPECTOR: Have you any idea, on present prices, as to what would be the saving per year?

The DEPUTY TOWN CLERK replied that he thought the amount would be, roughly, about £4000 to £5000.

Mr. *Haddock*: No; not that much. It might be somewhere between £2000 and £3000. The increased cost of labour, he added, might absorb a good proportion of the amount named.

The inquiry concluded without opposition.

BIRMINGHAM CORPORATION'S ARRANGEMENT FOR INDISPENSABLE MEN.

Last Friday a conference took place at the Birmingham Council House between representatives of the Gas, Water, and Electric Supply Committees with reference to the recruiting of men engaged by the respective departments—including the repair gang working on the water-mains between Birmingham and Wales. The question was discussed as to the steps to be taken to bring to the notice of the men the resolution adopted by the Council at their recent meeting—that those men who have war-service badges shall be treated, if taken by compulsion, as though they had voluntarily offered their services, under the resolution of the Council passed in September last.

It was decided that a notice should be posted in the various works concerned, to the effect that men with badges must not enlist, as they were as useful in their present capacities as they would be in the army. With regard to the unstarred men, they are to be allowed to enlist if they wish under Lord Derby's scheme, the general effect of which is that they are attested and return to their ordinary employment until called up. At the time they are called up, the employers may apply to the local tribunal to have them put in a later group.

Tees Valley Water Board.—At a meeting of the Tees Valley Water Board, held at Middlesbrough last week, a statement was presented respecting the annual charges on rates for the boroughs of Middlesbrough and Stockton and the district of Thornaby. For Middlesbrough, the charge for the year ended March 31 was £1618; for Stockton, £4446; and for Thornaby, £1163. The annual charges on the Corporations up to March 31 for interest, redemptions, and sundries were for Middlesbrough, £55,618; for Stockton, £49,446; for Thornaby, £10,163.

THE WOODALL-DUCKHAM RETORT INSTALLATION AT WORKINGTON.

The installation of Alderman Patrick Walls as Mayor of Workington gave him the opportunity of referring to the vertical retorts on the Woodall-Duckham system that were recently started in the town.

He said that, so far as local matters were concerned, the past year had been somewhat uneventful. But they had just completed what was, perhaps, the best and most up-to-date gas plant of its size in Great Britain. Their Gas Engineer (Mr. Horace Chamberlain) and the Chairman and members of the Gas Committee deserved the best thanks, not only of the Council, but of the citizens of Workington. The Chairman had devoted as much time and thought to the work as he (the Mayor) had ever known a man to devote to anything that was solely for the public good. They were fortunate to have the contract placed, and most of the work carried out, before war prices prevailed. If they had not taken action in the matter at the time they did, it would have had to stand over for years, whatever the consequences might have been.

Subsequently a letter written by Alderman Hall (who had proposed the election of the Mayor) was read to the Council, to this effect: "I have pleasure in informing you that in the twenty-four hours from six o'clock Monday morning to six o'clock this morning, the new carbonizing plant has produced without any special effort half-a-million cubic feet of gas from eight retorts. If you take into consideration that this plant only commenced making gas on the 4th of October, the record is unique in the production of gas in this country."

Gas Poisoning Fatalities.—Two inquiries were held by the Bradford City Coroner on Monday of last week into deaths from gas poisoning. One was a case of suicide, and the other of misadventure; the latter arising from a split in a gas-pipe, which caused the death of a widow during the night. At Swansea, also, a domestic servant was found in bed suffering from gas poisoning, to the effects of which she succumbed.

The New Carbonization Methods at Darwen.—Speaking at Darwen on Mayor's Day, Alderman John Tomlinson (who was previously Chief Magistrate in 1900-1-2) referred to the necessity of curtailing municipal expenditure. With regard to the new installation of retorts on the Munich chamber system, he said that no doubt it was due to the internment of the German erectors that a slight amendment in the plant became necessary. This, however, had been done at the cost of the Contractors. It was early to say that everything was now entirely satisfactory, or that the full benefits would accrue in the present financial year. He expected, however, that the following year their highest expectations would be realized. The Gas Engineer (Mr. A. H. Smith) supported him in this view.

Of High Repute!

—The Mediterranean Expeditionary Force Hospitals have installed Richmond's Gasfires, owing to their reputation as—

The SILENT Gasfires.

The Lancet says:—"We have had one of Richmond's Silent Fires under observation in a bedroom for several days, and the result is very satisfactory. . . . . . . It seemed incredible that gas was being consumed at the rate of about 30 feet an hour in a cheery red fire giving a genial warmth and comfortable aspect to the room."

The Reputation is well founded!

THE RICHMOND
GAS STOVE & METER CO.,
LTD.,
London and Warrington.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

On Thursday the Glasgow Town Council met to receive reports from less than twenty-seven different committees. The Gas Committee, their minutes, stated that the Town Clerk had sent to the various lliery owners and coal merchants with whom the Corporation had ade contracts for the supply of coal for the year ending June 30 next, ving notice in terms of the Price of Coal (Limitation) Act, 1915, that e coal under such contracts was excepted coal, and that the Corporaon proposed to claim the benefits they were entitled to under the Act. ir John Lindsay reported the replies which had been received, and bmitted the opinion of Counsel to the effect that the comparison prices to be made under the Act should be made with the sale prices yearly contracts, not isolated sales, in the year ended June 30 last, d that, as the only sales of coal for delivery in comparable quantities ver twelve months, which took place in that year, were those made by e Corporation in May or June, these last-mentioned sales, in the pinion of Counsel, were the only sales with which comparison in rms of the Statute fell to be made. It was remitted to Bailie Irwin, ailie Drummond, and Councillor P. G. Stewart to take whatever ction they might consider advisable in the interests of the Corporaon, to settle any questions as to prices arising under the Act in relaon to deliveries of coal from and after the 29th ult., under contracts r coal for the Gas Department for the year to June 30 next.

At a meeting of the Perth Town Council this week, there was some iscussion with regard to a minute of the Gas Committee, which set rth that it had been unanimously resolved that the present was an opportune time for giving an increase of wages to employees at the as-works. Ex-Bailie Macpherson, in moving adoption of the minute, id there were thousands of people in this country who suffered in come in consequence of the war, and had to pay the increased cost living, and who had no employers to go to. The agent of the men's nion had stated that if the increase was not granted they would appeal the Minister of Munitions. He understood they were taking this ep; and he thought the Town Council would be justified in holding eir hand until they saw what the Minister of Munitions said about e demand. Mr. Bruce moved that the question be remitted back to e Committee for their favourable consideration. Treasurer Clark id the discussion should not have been allowed, as the Council had ecided that no increases were to be granted. Bailie Beaton suggested at the speaker should be permitted to state his argument; but when r. Bruce resumed his speech many of the members left the Council hamber. Ultimately the Council adjourned.

At a meeting of the Kirkcaldy Town Council on Monday, the queson of the threatened strike of the gas-workers was under consideraion. It was agreed, on the recommendation of the Emergency Comittee, to grant an increase of wages; the employees being found to be nderpaid, as compared with similar workers elsewhere.

On Wednesday evening, Mr. Alex. Yuill, the Manager of the Dundee Gas-Works, delivered a lecture entitled "Our Gas-Works"—one of a course of lectures organized by the Dundee Educational Committee. In the course of an interesting and instructing talk, Mr. Yuill dealt with the history and physics of gas as an illuminant. He touched upon the multifarious uses to which gas is now put—including the manufacturing of munitions of war. In Dundee in 1900 the make of gas was 622 million cubic feet, whereas in 1915 it had risen to 1137 millions. The coal used, and equivalent of oil, was 105,000 tons; the coke and breeze produced 59,000 tons; the tar made, about 6000 tons; and the sulphate of ammonia produced, 1200 tons. The number of men on the staff is 386; and the number enlisted to date 120. Mr. Yuill, by demonstration and experiments, showed the growth of gas as an illuminant from its earliest stages, as also demonstrating the combustion of gases. Lantern slides of the Dundee Gas-Works were shown; and at the close the lecturer was accorded a hearty vote of thanks.

Women gas-meter inspectors are being appointed in Glasgow. The examination they have to pass before entering the service is described as a "fairly stiff" one. Quite a number of candidates have qualified, and are now making a beginning at meter work.

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Nov.* 15.

There is no point of interest in the tar products market, values generally being unchanged.

Sulphate of ammonia continues to be in a strong position; the prompt price being £15 7s. 6d. to £15 10s. net per ton, filled into buyers' bags at makers' works, for 25 per cent. quality.

Tar Products in the Provinces.

Nov. 15.

There is little alteration in the markets for tar products. Pitch is still very weak, and lower prices have been accepted at some ports. Fair quantities of creosote are offering at reasonable prices. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 19s. 6d. to 23s. 6d. Pitch, East Coast, 18s. to 19s. per ton; Norfolk, Suffolk, and Humber ports, 18s.; West Coast, 16s. to 17s. Manchester;* 17s. to 18s. Liverpool; 19s. to 20s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d.

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* Owing to a clerical error, the price of pitch last week was inserted as 17s. to 18s., whereas it should have been 16s. 6d.—a price at which a fair quantity was sold.

Kindly forward us YOUR enquiry to-day.

R. & J. DEMPSTER, Ltd.,
MANCHESTER.

London Office:
165, Gresham House,
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Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Nov.* 13.

During the past week the tone of the market for this article has remained very strong, and a further substantial rise in prices has taken place. Demand has continued on a big scale, but supplies have been rather limited, and consequently the amount of actual business concluded has been restricted. The closing quotations were £15 15s. per ton f.o.b. Hull, £16 f.o.b. Liverpool, and £16 2s. 6d. f.o.b. Leith. In the forward position, makers have now assumed a very conservative attitude, though first-hand sales have been reported at £16 per ton for January-June, and at £16 5s. for January-March, f.o.b. good ports.

Nitrate of Soda.

This market has continued steady throughout the week, and spot prices are unaltered at 14s. 4½d. per cwt. for ordinary quality and 15s. 4½d. for refined.

Sulphate of Ammonia.

From another source it is stated that the market for this article has remained firm throughout the past week. Outside London, makes are quoted at £14 12s. 6d. to £14 15s.; Hull, £15 12s. 6d. to £15 15s.; Liverpool, £15 15s.; Leith, £15 17s. 6d.; Middlesbrough, £15 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is generally steady; and while for prompt delivery the supplies are barely adequate, the fluctuations in the arrivals of steamers might soon affect this, though the difficulty in obtaining the export licences is now much lessened. The collieries, however, have tonnage booked in most cases for this month. The steam coal market is moderately active, and thus the range of prices is sustained. Best Northumbrian steams are quoted from 19s. 6d. to 19s. 9d. per ton f.o.b.; second-class steams are 16s. 6d. to 17s. per ton; and steam smalls are in good supply at 10s. 6d. to 13s. per ton. Forward quotations are more irregular; but it is expected that a Government demand will give some amount of briskness to the steam coal trade. The gas coal trade is active, and a good inquiry for Durham coal generally is experienced. Best Durham gas coal is 19s. 6d. per ton f.o.b.; second-class gas coal is from 16s. 6d. to 17s. 3d. per ton; and for "Wear Specials," there is a steady quotation of about 20s. per ton. The output of gas coal is good when the limitation of miners at the collieries through enlistment is borne in mind. Long-contract quantities of gas coals take up much of this output, and the foreign shipments are fair, especially for France. The cost of sea carriage is higher—as much as 13s. has been quoted from the Tyne to London, and about 21s. to Rouen, but running contracts are at lower rates. An inquiry is in the market for 30,000 tons of Durham gas coal for Denmark for next spring shipment, which may test the forward prices. Coke is rather dearer for some kinds. Good gas coke is quoted from 27s. 6d. to 29s. 6d. per ton f.o.b. in the Tyne. There is a larger make now, and stocks at some of the inland works are slightly larger.

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Nottingham Gas Undertaking.—Mr. W. Gath, one of the Nottingham City Auditors, in his annual report as to the gas undertaking, states that the surplus assets are equal to 49·73 per cent. of the capital expenditure, or, in other words, that nearly 50 per cent. of the undertaking belongs to the Corporation. The remainder is represented by the holders of annuities and other stock.

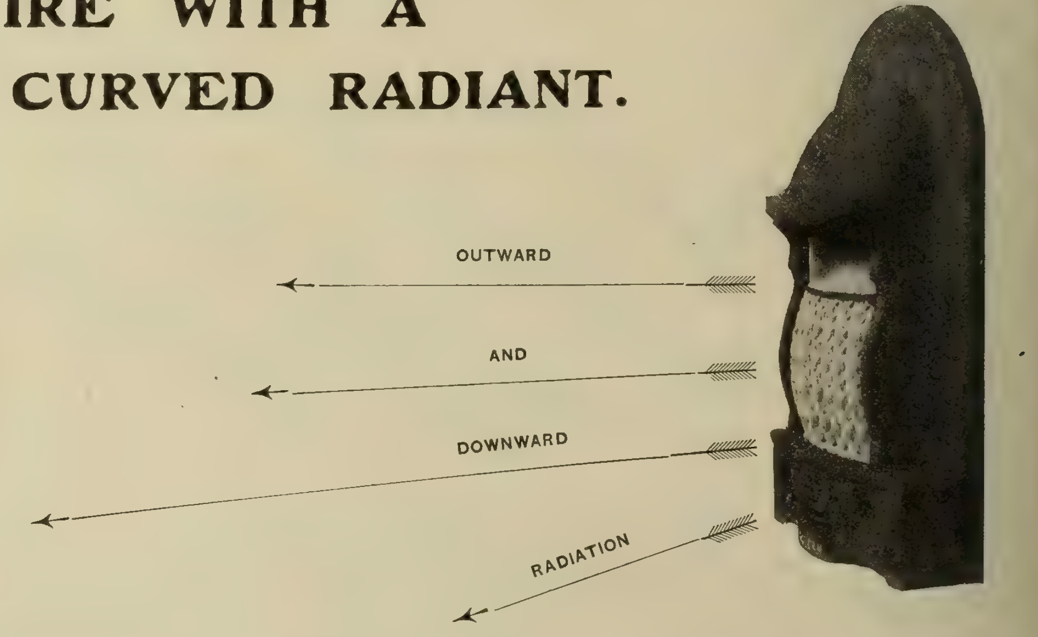
Birmingham Committee Chairmanships.—Alderman Sir Hallewell Rogers has been re-elected Chairman of the Gas Committee of the Birmingham City Council, and Alderman J. H. Lloyd has been re-appointed Chairman of the Water Committee. As both have been Chairmen of their respective Committees for more than three years, their appointment for the ensuing year will, in accordance with the Standing Orders, have to be confirmed by the City Council.

Public Lighting of Manchester.—The Manchester Watch Committee, last Thursday, in response to the wishes of the public, decided to ask the Home Secretary to remove the lighting restrictions in the city. The question had been raised on many occasions by various public bodies, by Coroners' jurors, and by the Gas Committee of the Corporation; Alderman Ashton bringing the matter before the latter Committee. At the meeting of the Watch Committee alluded to, it was agreed—"That the Town Clerk be instructed to make suitable representations to the Home Office, with a view to the Order as to the lighting of the City of Manchester, issued by the Home Office on April 8, 1915, being withdrawn."

Quality of the Gas at Burton.—Referring to the fact that many complaints regarding the quality of the gas have lately been received, Alderman Lowe, in submitting the report of the Gas and Electricity Committee at the last meeting of the Burton-on-Trent Town Council, explained that the special requirements of the present time necessitated the putting into operation of processes which had a deleterious effect on the illuminating power of the gas, though they were doing all they could to save the public from inconvenience. A letter had been received from the authorities giving the assurance that, should they fail to supply gas of the quality required by their Act, they would be indemnified against any claim that might be brought by consumers in the town.

An Obvious Advance.

A FIRE WITH A
CURVED RADIANT.



A Maximum of PURE RADIANT HEAT.

The "LANCET" says "This fire showed no escape of combustion products into the room whatever."
The "LANCET," June 12th, 1915.

MANUFACTURERS:
THE VULCAN STOVE CO., Ltd. EXETER.

Portsmouth Water Company.

Special interest will attach to the half-yearly meeting of the Borough f Portsmouth Water-Works Company on Thursday, in view of a iotice of motion regarding the payment of back-dividends which has een given by Colonel Ford, V.D. The Directors report that the vailable balance on the profit and loss account is £32,338, out of vhich they recommend the payment of the full statutory dividends, vhich (after providing for void houses) will leave a balance of £12,258 o be carried forward. During the half year to Sept. 30, 120 yards of dditional street service mains were laid—the total length of these now eing slightly over 175 miles. No trunk mains were laid during the ix months; the length of them remaining as it was six months ago—amely, 67¾ miles. The net increase in the number of supplies was 48; the total number of premises under constant supply throughout he whole of the Company's district being (at the end of September) 4,086, and the number of consumers approximately 267,500. The uantity of water supplied for all purposes during the half year was .719,686,000 gallons—equal to an average supply of approximately ,397,000 gallons per twenty-four hours. The Company's engines, oilers, filter-beds, reservoirs, mains, and works were reported by the ngineer and General Manager (Mr. Herbert Ashley, M.Inst. C.E.), be in good working order. The back-dividends resolution referred above will be moved in the following terms: "This meeting esolves that the following shareholders (not being Directors) be and re hereby constituted a Special Committee to consider and report to ie shareholders at the next half-yearly meeting whether it is desirable iat steps should be taken to provide for the payment of back-dividends, nd if the Committee recommends that steps be so taken, then it is to iggest a suitable course for this purpose. And to this end the Committee is to confer with the Directors, and to have the assistance of ie Secretary of the Company; and the expense of this inquiry is to be orne by the Company."

◆

Midland Mayoralties and Gas Committee Chairmanships.—In wo of the youngest among Midland municipalities the Chief Magisates elected for the present year also hold the office of Chairmen of ie Corporation Gas Committees. At Ilkeston, the re-election of Mr. A. Macdonald was for the third year in succession. Mr. Macdonald's xcellent work for the municipality, and particularly in relation to the as undertaking, has been widely recognized throughout the town. t Mansfield, the unanimous choice of the Council fell upon Mr. T. mith, who has also acted as Chairman of the Gas Committee. eference was made to trying difficulties with which, in this position, e had had lately to contend. The interesting circumstance was realled that a few years since, during a period of change in the gas anagement, Mr. Smith acted as Manager of the Mansfield underking; and during his half year of office he had the satisfaction of ontributing from the profits about £1500 in relief of the rates.

Oriental Gas Company, Limited.

The meeting of this Company will be held to-morrow week at the London Offices, Finsbury House, Blomfield Street, when the Chairman (Mr. H. D. Ellis) will have the satisfaction of presenting a report for the financial year to June 30 last showing that the final dividend of 4½ per cent. (making 8 per cent. for the year) has been earned with a slight balance in hand. In the course of the report it is stated that the effects of the war have been severely felt in India. Trade has been much hindered; enterprise repressed; and the normal demand for commodities abated. Economies have been enforced by stress of circumstances far and wide—upon corporate bodies, communities, and individuals. Among these economies, a saving of expenditure upon gas, wherever possible, and a contracted market for residual products, were to be expected. In contemplation of such a contingency the Directors took into their careful consideration how best to meet a prospective reduction of revenue by a diminution of expenditure consistent with sound economical principles, and the maintenance of the Company's works, plant, and buildings in a thorough state of efficiency. In this aim they have been successful. While, on the one hand, the revenue account shows a gas-rental lower by about 7⅝ per cent., and a reduction of 18 per cent. in the yield of residual products owing to very severe market depression, large savings have, on the other hand, been effected under the chief heads of expenditure; and the item of bad debts and allowances is, in spite of war conditions affecting all classes of consumers, lower by £614 than the corresponding figures for the preceding year. In result, the reduction in revenue has been more than counterbalanced by £75 5s. 5d. The operations in the nature of extensions and additions properly assignable to capital expenditure have not been upon a considerable scale. So much had been done in the previous year to anticipate requirements of this nature that the comparatively light sum of £3200 covers all the outlay which has fallen to the charge of the year under review. The whole of this outlay has been defrayed out of the revenue of the year, without recourse being had to the reserve fund. The rate of exchange has been adverse, it is pointed out—a minor result of war conditions.

◆

Middlesbrough Municipal Undertakings.—On assuming the office of Mayor of Middlesbrough, Mr. J. Calvert (late Chairman of the Gas Committee) said the total indebtedness of the town was £2,379,168, and the assets he calculated at £3,407,807. They had productive assets almost equal in value to the amount of the debt. Their share in the water-works (Tees Valley) was over £1,500,000; and the gas-works and electricity works had cost £600,000. Apart from the water-works, these enterprises did not cost the ratepayers anything. Two of them yielded something year by year; and even in regard to the water, it only cost the ratepayers a 0·82d. rate. If the value of these three productive works were deducted, it would be seen that they had redeemed as much money during the life of the Corporation as to pay for almost all their other properties.

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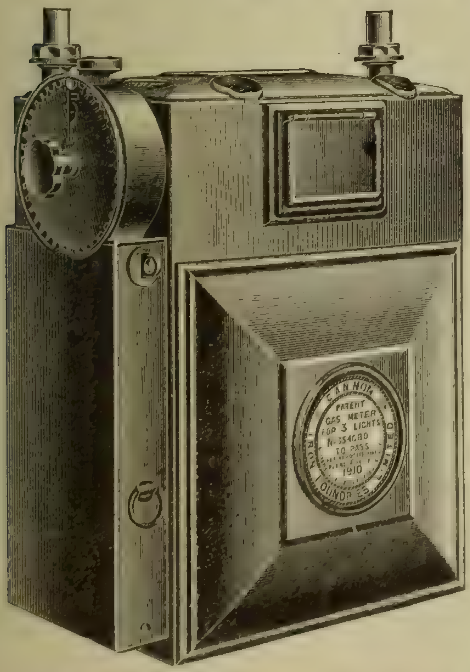

Serious Gas Leakage from a Broken Main.—Suspicion rests on a Corporation steam-roller (which had recently been at work in the street), in connection with a serious occurrence at Bridgwater recently. On a man named Reed not turning up at his work last Friday week, a fellow employee called at his house to ascertain the reason; and entering by means of a window, he found Reed, his wife, and five children all unconscious in their beds, suffering from gas poisoning. The visit was a fortunate one; for no doubt had the victims remained undisturbed they would all have been suffocated. It appears that on the previous evening an escape of gas had been detected in the street; and the matter was reported to the Gas Company, who sent a man to investigate the matter.

Midland Gas-Workers' Organization.—In a report just issued by the Nottingham executive of the Gas-Workers' Union attention is directed to some significant figures; it being stated that, in the district of which Nottingham forms the centre, some 1200 men have, under the conciliation rules, received advances of pay. A war bonus of 2s. weekly has been obtained in a large perecntage of the cases. Further petitions are now being pressed, including one in connection with the Derby Gas Company. A statement in relation to the wider scope of the organization's operations throughout the country shows a total membership for September of 140,896, *plus* 28 per cent. now serving with the Colours, against 137,546 in June last. It must be remembered that the Union takes within the scope of operations, not merely gas-workers, but a host of others falling within the category of general labourers.

Nottingham Gas Committee.—The Nottingham Gas Committee has for the next year been enlarged by the addition of two members, and the scope of the work extended by the absorption of the duties hitherto discharged by the Lighting Committee, who have for many years fulfilled independent functions. Apart from the present abnormal conditions, which have brought the operations of the Lighting Committee almost to a standstill, the change has for some time been regarded as desirable, as tending to greater efficiency of working. With the return of normal times, one effect of the alteration may be to facilitate the adoption (the desirableness of which the Chairman of the Gas Committee suggested many months ago) of a standard burner for street illuminating purposes; it being felt that the Lighting Committee have been experimenting with an unduly large variety of types. To the great advantage of the city, Alderman Albert Ball will continue his services as Chairman of the enlarged body.

Doncaster Gas-Works Expenditure.—At an adjourned meeting of the Doncaster Town Council, Mr. Wightman took exception to a minute of the Gas Committee which recommended that, in view of the existing Treasury restrictions, further expenditure on new plant, mains, and meters be paid out of revenue. He wanted to know whether they had exceeded their estimate. Alderman Armitage replied that he was not aware that they had exceeded their estimate; and what work they did they proposed to do out of revenue. Mr. Clark said it was well known that the Treasury had refused to sanction any expenditure unless absolutely essential. They had agreed to an item of £270, and the new mains to which Mr. Wightman evidently referred were work which the Council would have agreed to, and a great public injury would have arisen if it had not been done. The work had been carried out in the most economical way. Mr. Wightman said he did not object to the work being done, but to the way in which it had been done.

The Fatality at Nelson.—The fatality to a labourer at the Brierfield Gas-Works of the Nelson Corporation, which was referred to on p. 336 of last week's "JOURNAL," was the subject of an inquest last Tuesday, when the Jury returned a verdict of "Accidental death." Deceased had been engaged in his ordinary employment of shovelling coke into the elevator to the hopper; and on search being made when he was missed, his body was found buried beneath the coke breeze in the hopper. Robert Frankland, foreman at the works, said deceased's duty was to receive coke from the trucks, and shovel it into the elevator, which carried it into the hopper. The full load of the hopper was about 5 tons, and 27 cwt. had been taken out during the last fortnight; but, in spite of this, it appeared to be full. He could not suggest how deceased had got into the hopper, because it was not his duty to go there; and it was situated 100 yards away from where he was working. The depth of the breeze was about 12 feet. He had never seen deceased go on to the top. After taking out 27 cwt. of the breeze, there would be a fairly large cavity. It was dangerous to step into the hopper and on the breeze; but he had never pointed this out to the men in any way. The hopper was not now in use. All the time the elevator was working, breeze gradually got into the hopper. If the mixture of the coke and breeze had been solid at the bottom, there would have been no danger. The Coroner said deceased, for some reason or other, went on to the top of the hopper containing the breeze and coke; and this collapsed beneath him, and in consequence he died from suffocation. He thought that in future directions would be given to the men that they must be very careful, and not get into these hoppers. The Town Clerk, on behalf of the Corporation, expressed sympathy with the relatives. The man had, he said, been perfectly satisfactory in his services.

APPLICATIONS FOR LETTERS PATENT.

15,344.—MILLER, A. J., "Gas-furnaces." Nov. 1.

15,351.—HODGSON, J. L., "Meters." Nov. 1.

15,467.—LYMN, A. H., RILEY, L. A., and RAMBUSH, N. E., "Gas-producers" Nov. 2.

15,480.—LIVESEY, R. M., "Acetylene generators." Nov. 3.

15,585.—JOHNSON, J. Y., "Gas-producers." A communication from W. Wood. Nov. 4.

15,628.—RADMORE, L., and MILLER, W. P., "Acetylene generators." Nov. 5.

15,701.—HERSEY, M. H., and ANDERSON, D., "Mantle rings." Nov. 6.

15,717.—MORGAN, P. B., "Gas-producer." Nov. 6. [Divided Application on 6999/15. May 10.]

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STOCK MARKET REPORT.

HE general tone of the markets on the Stock xchange last week continued to be favourable, oupled with strong points in some lines, and isiness was fairly active. But movements ere not, and could not be expected to be, con- nuously upward, for the recent long run of sing prices led to the ever-inevitable realiza- ons to secure profits. However, these ran eir course unharmfully, and left markets un- paired in vitality. The solid factors that ake for enduring strength, the grand harvests, id the signs of advancing prosperity in many nds, still held good. Space does not permit etailed particularization; and it may suffice say that this feature extended over both emispheres, with Canada in the West and pan in the East as conspicuous examples. ne progress of Home Rails in public favour as a welcome item. In the Miscellaneous oup, advancing freights advantaged shipping. ne most buoyant line was rubber, actuated by smart rise in the market price of that commodity. A noteworthy event of the week was large meeting of Stock Exchange members to ge the Committee to bar the re-election of all ho are of alien origin—a numerous and power- l body. Much strong feeling was evinced, d a resolution was carried. It is a matter hich is not devoid of difficulties; and the legal wers of the authorities should be carefully vestigated. Another incident affecting the change was the decision of the London earing bankers to close at 3 o'clock. Business the Gas Market showed some recovery in int of volume, and prices generally may be oted as steady. Before the close, Imperial ontinental was done at 70—this was after the neral meeting of the Company held on Thurs- y. In the Money Market, short loans were sy, with an abundant supply; but the dis- unt market was much perplexed on Friday the advance to 5 per cent. for Treasury lls of all dates.

Bargains done for cash during the week were follows: On Monday, British 35⅛ Gas Light dinary 76½, 77, ditto maximum 59¾, 60, Im- rial Continental 65½, 66, South Metropolitan , 75⅛, 75½. On Tuesday, British 35½, Gas ght ordinary 76¼, 76⅜, 76½, 76⅝, 76¾, ditto benture 62½, South Metropolitan 76, ditto benture 60⅜, 60¾, 61. On Wednesday, Com- ercial 4 per cent. 80, Continental Union 38½, as Light ordinary 76¼, 76⅜, 76½, Imperial ontinental 65, 66, South Metropolitan 76½, . On Thursday, Gas Light ordinary 76¼, ⅜, ditto debenture 63, Portsea "D" 90¼, 90½, uth Metropolitan 76½, South Suburban pre- ence 90½, Tottenham "B" 98½, 99. On Fri- y, Continental Union 38½, Gas Light ordi- ry 76¼, 76¾, ditto debenture 62¾, South Met- politan 76½, 76⅝, 77. On Saturday, Gas Light dinary 76½, ditto preference 73, 73½, ditto benture 63, Imperial Continental 70, Primi- a 2 5/16, 2⅜, South Metropolitan 76¾. Recent alings in Derby ordinary at 110-112½, and to debenture at 83-85, are reported.

The Bank rate is 5 per cent.—as fixed on g. 8, 1914.

The Directors of the Monte Video Gas mpany, Limited, have declared an interim idend, payable on Dec. 1, of 6s. per share, s income-tax, for the half year ended June 30.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div. or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	..
874,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
378,480	10	"	7	7/-	B 7 p.c.	15—15½	4 10 4	..
95,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
147,240	—	—	—	4	Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 8	..
330,000	"	"	†11	55/-	Do. New	204—209	5 5 8	..
50,000	"	"	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	35⅛—35½
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb.Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	80
560,000	"	"	5⅛	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	..
800,000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	38½
200,000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	76¼ 77
2,600,000	"	"	3½	3½	3½ p.c. max.	76—79	4 8 7	59¾—60
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10	73—73½
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	62½—63
130,000	"	"	10	10	10 p.c. Bonds	..	—	
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C	151—154	5 2 4	..
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	65—70
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7		B	146—148	4 14 7	..
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb.Stk.	..	—	..
75,000	5	June 11	6	4/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c.Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4¼	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	"	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	"	10	—	Do. D	..	—	90¼—90½
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 13 4	2 5/16—2⅜
499,960	5	June 26	5	2/6	" 5 p.c. Pref.	4¾—5	5 0 0	..
521,600	100	June 2	4	4	" 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	"	"	10	10	Do. B	222—224	4 9 3	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75—77
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60⅜—61
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	..
60,000	"	"	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	90½
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c.	135—138	5 8 8	..
742,275	"	"	6	6	B 3½ p.c.	115—117	5 2 7	98½—99
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/8	55/1½	" C 3½ p.c.	110—115	5 2 0	..
352,000	"	"	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	"	"	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

The Engineer of the Walsall Gas-Works (Mr. B. W. Smith) has en instructed to report as to the adoption of a scheme of appren- eship for the gas-fitters' lads, so that steps may be taken to have em properly trained.

The Doncaster Town Council have received intimation from the easury that there would be no objection to the borrowing of £286 in pect of capital already expended on mains, but that sanction could be granted to any further borrowing for purposes of the gas under- ing.

To economize coal and gas, the Birmingham Education Committee have decided to revise the afternoon hours of the elementary schools. They will be half an hour earlier—from 1.30 to 4 o'clock.

The Leeds Corporation have issued a statement of their war allowances to Corporation employees who have enlisted; and it is shown that up to Oct 31 last 203 employees of the Gas Department who have enlisted have received £3550 in half-wages and allowances. The waterworks have sent 36 men. Of the total of 1649 contributed by all departments, 412 are officials and the remainder workmen.

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EDITORIAL NOTES.

Ammonia Loss during Storage of Liquor.

AN interesting communication on the above subject is made through our columns this week by Mr. W. S. Curphey, the Chief Inspector under the Alkali Works Regulation Act. On various occasions during the past two or three years, attention has been called, in presidential addresses and papers and in Mr. Curphey's reports, to the loss of ammonia that arises during the storage of ammoniacal liquor where there is air circulation above its surface. One suggestion made some time since for the prevention of this loss was the use of a film of suitable oil on top of the liquor. In his Presidential Address at the informal meeting of Scottish Gas Managers, in 1914, Mr. William Wilson, of Falkirk, spoke of the good effect that he had found by using a thin film of paraffin on the surface of stored liquor. The oil form of protection has now been the subject of extended test at five different works.

In his communication, Mr. Curphey gives the results of the tests at three of the works; and they are surprising as to the loss of free ammonia that takes place from untreated liquor surfaces, and as to the efficacy of a layer of oil on the surface. One point more particularly noteworthy is that the thinnest film of mineral oil used—a film only 0·08 inch thick—showed an extraordinarily good result. But the temperature of the liquor was somewhat lower in this case than in the other two. Details, as to conditions of storage, temperatures, &c., must be obtained from Mr. Curphey's communication. But salient figures from the trials at the three works, it will be seen, with losses computed in 100 parts of free ammonia, are: After 80 days (without oil protection) 43·2 per cent. loss. This is a large figure. But in a period of equal duration, with a layer of oil 1¼ inches thick on top of the liquor, the loss was only 0·5 per cent.—a difference of 42·7 per cent. In the next works under the conditions described, there was (without oil protection) a loss in 79 days of 20·8 per cent.; but with a ⅕-inch layer of crude paraffin oil, the loss was, in an equal number of days, only 0·4 per cent. Then at the third works, the loss, under the conditions explained, was in 92 days 38·7 per cent.; but, with a film of 0·7 inch of mineral oil, the loss in 92 days was only 0·5 per cent. Then in a trial with 0·08 inch film of mineral oil, the oss in 70 days was only 0·3 per cent. From the information gained, it is clear that, as Mr. Curphey points out, a layer of $\frac{1}{10}$ inch of oil should afford complete protection. The figures are remarkable; the lesson one of which large use will be made in these days when improved results in every direction where possible) are essential in the world's economy and nterests. For this lesson, we thank Mr. Curphey.

Coke-Oven Managers' Association.

IN last week's issue, we gave a report of the first meeting of this Association, held the previous Saturday at Sheffield; but there was not then an opportunity to extend, in the editorial columns, a welcome to the new organization, and o comment on its advent. We do both now with particular pleasure. The Association starts upon its career (which should make a considerable impression progressively upon he coking industry) with a fine robustness. It is computed hat there are in the country some 104 coke-oven plants; and the managers of something like half these are already members of the Association. The first President (Mr. George Chrisp, of the Dalton Main Collieries) and his associates on the Council must be cordially congratulated upon his excellent entry into corporate existence. This has come about none too soon; and no one recognizes it more han the members themselves. Had the organization come on to the scene long since, the President would not have had such considerable difficulty in collecting and combining the scattered data that form such an important feature of his address, and which will be very valuable to the future historian of the coking industry, while the Association would not then have had so much heavy spade-work awaiting it for the raising of the industry to a higher state of technical efficiency.

It is admitted on all hands that there is much to be done in this latter respect. The coke-oven industry has, especially of late, been the subject of reproach all round for the waste that has proceeded, and is still proceeding, where there has been, or is, inadequate technical supervision, and which waste is incapable of denial in the face of the excellent results accruing where the technical supervision is of a high order. The beehive ovens are a standing disgrace to an age in which scientific aspirations and control are in the ascendant; and in relation to bye-product plants, there is an enormous amount to be done in attaining maximum efficiency, and earning from such plants the profit that should be realizable from the still latent potentiality. Fuel economy and use are most important in connection with such plants; but there is not general attention to the subject. But CO recording instruments, and the practice of gas analysis, would do much in this direction. The Hon. Treasurer of the new Association (Mr. B. W. Haigh) pointed out at the meeting that the development of power at collieries was also an important matter; so too is the quality of the bye-products, and the assurance that every ounce of benzol is recovered. It is openly confessed that at many coke-ovens there are avoidable losses of heat, tar, and ammonia. A significant development is the taking of gas from coke-ovens for town supply at both Middlesbrough and Leeds, the parliamentary powers secured by other corporations for doing likewise, and the utilization by the Yorkshire Power Company of coke-oven gas for electricity generating purposes. These are only beginnings, but they are "signs of the times," and indicative of the direction in which economic expansion promises to proceed in the coking industry.

The opportuneness of the Association needs no further attestation, though we should be sorry if anyone should take admitted shortcomings in operation and control as applying universally. They do not. But economy is now in the air; and the maximum volume of certain of the secondary products of coal carbonization is now required, and the future will make increasing claims upon them. Coke-oven managers cannot continue under the imputation that their plants are not doing the best possible—such imputations as Professor W. A. Bone made in his British Association address on "Fuel Economy," and such as have been made more than once in papers emanating from South Wales. Not long since, too, the "Iron and Coal Trades "Review" attacked the waste that is proceeding in connection with beehive ovens. Nothing whatever has appeared from coke-oven managers controverting these imputations. Perhaps it is better so; and perhaps, too, it is better that through conference and organized endeavour, the coking industry should be set above these continual attacks.

In this work lies the ultimate object of the Association. Hitherto the coke plant owners have been operating as separate elements, without anything visible in the way of unity of interest or common bond. The Association provides such a bond, and the unity of interest will grow with time. And, speaking of this, we have seen on more than one occasion statements that there is little in common between the coke-oven industry and the gas industry. Those who are responsible for such statements are incapable of making proper analysis of the situation, or of forming fair anticipations for the future. It is true our primary products are different. Metallurgical coke in the one case; gas in the other. But both industries are concerned in the carbonization of the same material—true, generally speaking, in largely differing weights per charge. But the gas industry is moving upwards in this respect, until in certain gas-works chamber ovens are already in use. As has been previously remarked, too, business has commenced in the sale of gas to town-gas suppliers of the gas that is produced by the coke-oven industry; and with the growth of this business, there will probably be seen the increasing use for oven heating and steam-raising of producer gas made from colliery waste. The secondary products of coke-oven plants find exit in the same markets as the secondary products of the gas industry. Swelling production will place the interests of the two industries on a still more common basis. Already they are united in the Sulphate of Ammonia Association; and the success in this direction may lead to further developments when need demands. The common interests commercially of the two industries will be intensified with the movement in the gas industry which has led a number of undertakings to enter upon first-stage tar distillation, while a few of the larger concerns are already tar distillers on the full scale; and we may see in the not distant future groupings of undertakings for the provision and working of central distillation plants. Taking all these facts into due consideration, the relationship between the two industries is marked; and we confidently believe that, through the new Association, mutual interest will ripen, to the advantage of both industries. This being so, we cordially welcome the Association, and wish it all the success in good work that its originators could hope for.

Criticisms by the Gas-Fitting Examiners.

A very useful report regarding the examinations in gas-fitting has reached us from the Department of Technology of the City and Guilds of London Institute. It is a report by the Examiners (Messrs. H. Kendrick and R. Halkett) commenting seriatim upon the character of the work done in connection with the questions set in Grades I. and II. and Final Examinations this year. The usefulness of the report (which is reproduced in other columns) lies in the fact that its general publication and its circulation among teachers —for which publication and circulation we can thank a suggestion by the Council of the Institution of Gas Engineers —will do much to enhance the value of the examinations. If anything more than was known from general experience were required to prove that examinations were a *sine quâ non* to the improvement of the knowledge and capacity of gas-fitters, these examinations have already supplied it. Vital defects in machinery and structures are often only traceable by the most scrupulous examination, and not till found can the remedial measures be applied. The examination of the candidates in gas-fitting has opened the eyes of Messrs. Kendrick and Halkett not only to the extent of the deficiencies that exist among fitters, but of the incompleteness of the methods of their training generally, and of the education that is being given to them by their teachers. This is not said in any spirit derogatory of the voluntary work that is being done; the gas industry is really grateful to those who have undertaken the work. It has to be recognized that this is a new work; and we cannot expect perfection all at once. Teachers (fresh at the work) must be informed as to the range of subject that will be covered by the Examiners, the matters upon which there is most generally defective knowledge, and the best methods of inculcation. We cannot help thinking that it would be an excellent thing if the Examiners and the teachers could be brought together for a conference, with a view to, at the outset, doing something to co-ordinate the system of instruction and the scope of work. Up to the present, matters appear to have been left very much to the devices and discretion of the individual teachers; and the report before us indicates how indifferently has been covered the range of knowledge embraced by the questions, or, if covered, how little has been the impression made by the instruction.

There must be forgiveness for plain speaking in this matter, for it is a vital one for the industry; and we only speak plainly with an eye to improvement, so that the utmost good may be derived from the work of the teachers, and from the time bestowed upon preparation by the candidates. The comments attached by the Examiners to the questions show a lamentable lack of knowledge among the candidates on the technic of provision, utilization, and conditions for realizing the best effects from gas consumption. It is quite clear, too, from the comments that standing out from the replies to the questions are local custom and local training rather than a broad grasp of principles and knowledge that aid in discrimination and determination in providing for the realization of the best results. Candidates also require to be instructed to answer questions in more detail, and not leave to the imagination of the Examiners the state of the knowledge of the candidates from their outline replies. When, again, they are asked to give reasons for preferences as to a certain line of operation, they should be instructed to state as their reasons not only the advantages of their chosen line of procedure or type of apparatus, but the disadvantages of the rejected procedure or type of apparatus.

It is surprising to read some of the criticisms of the Examiners. They show a large unpreparedness for even such tests—simple to the extreme on this occasion—as were provided for Grades I. and II. Who would have expected that in Grade I. a "large percentage" of the candidates would not know what was meant by type of meter, nor anything about the construction of either wet or dry meters? Who, too, would have believed that a gas-fitter existed who, presenting himself for examination, did not understand the common nomenclature and methods of statement in connection with gas pressures, but appeared obsessed with the beliefs that pressures had to do solely with high-pressure lamps, and that pressures were only expressed in inches of mercury and pounds per square inch? The fact, however, that they were able to make reply in the latter direction is an indication of a capacity and intelligence quite equal to quickly becoming acquainted with the simpler rudimentary knowledge. The same thing is found in other places in the report, which seems to suggest that it has been mistakenly taken for granted that the "A.B.C." of the fitter's education has stable existence, and that tuition should at once go beyond the initial stage. In the final examination, for example, the candidates were asked, What is convected and radiant heat? Only a small proportion of the examinants attempted this question; but the answers given "were good, "and showed a sound knowledge of the laws of convection and radiation." On the other hand, there was, even in the final stage, a painful lack of knowledge regarding hot water supply. In Grade II., most candidates, the Examiners say, had an idea that pipe areas and discharges have some relation, and that the length of pipes will affect delivery capacity, but they were ignorant of the law and principles regulating capacity, and the effect of friction was apparently not understood. These are instances only; and they appear to show that, generally speaking, the material on which the teachers have to work has receptivity if only the instruction is gone about in a proper and systematic way.

We are not prepared to blame the candidates altogether for providing the Examiners with so much scope for comment. Almost entirely the comment is fully justified; but in two cases on the point of interpretation of the Examiners' questions—Questions 3 and 6 in Grade I.—a little misconception on the part of the candidates was excusable. The teachers will, as already intimated, find that the report can be read as—we will not put it—censuring their instructional work, but as advisory. They will also learn much from this study of the shortcomings of their pupils. Apart from the points mentioned earlier in this article, the teachers must encourage sketching; and there should be practical instruction with different types of apparatus which can be thoroughly dissected before the pupils, and every part and its use explained. The teachers will further note the warning given by Mr. Leonard G. Killby in the circular-letter that accompanies the report—that next year the practical tests are to be somewhat more severe, and that the standard of the test in Grade II. will approximate to that of the final test set in the 1915 examination. All candidates, in addition, will be examined *vivâ voce* by the local examiner. It was thought by many that the first examination was of far too simple a character; it was judiciously so for a start. But the notification shows it is going to be intensified. This being so, the responsibilities of both teachers and candidates will be greater, and the value of the successes of both will consequently be enhanced.

Wasting Crude Tar on Roadways.

Quite naturally where gas-works have not a dehydration plant, there is a great temptation to sell, and for highway authorities an equal temptation to buy, crude tar, if the refined or distilled product cannot be readily obtained. Though it is not patriotic to do this, it seems that it has come to the knowledge of the Ministry of Munitions that there are still in some quarters transactions in the crude material. The result of this is that Mr. H. P. Maybury, the Manager and Engineer to the Road Board, has forwarded to County Councils, Urban District authorities, and Rural District authorities circular-letters, urging them to omply with the request made, as far back as March, that he use of crude tar for road purposes should be wholly bandoned. One would have thought that this request vould have sufficed, in view of the vital need that exists n these times for the complete extraction from the tar of he benzol, toluol, and phenol compounds for the manufacure of high explosives. In one of the circular-letters, Mr. Iaybury puts forward certain possible palliating reasons or the continued use of crude tar. But if they are good nd sufficient as applying to the past, there will be no eason for their further application as excuses for doing omething that is quite against the national interests. The easons are that the use of the crude substance may be due o the fact that the tarring operations had commenced, r that contracts had been entered into under which large uantities of crude tar were purchased, or that the importnce of the request was not sufficiently realized. With all espect to Mr. Maybury, we think it would have been inder not to have included the last-named reason, as it is ot exactly a tribute to a rich intelligence on the part of the ighway authorities who take cover under it.

The Road Board now urge that arrangements should be romptly made whereby the employment of crude tar is ositively prevented, and co-operation is effected with the Iinistry of Munitions in a manner which will ensure that nly refined tar is used in future. There ought to be no ifficulty about complying with this request. If there is ot now compliance, we should not be surprised if the use of rude tar during the period of the war is not made absolutely legal. The highway authorities need have no trouble in e matter. All they have to do is to see that the tar purhased conforms with the specifications of the Road Board. f it does, then the authorities are carrying-out their road perations with the tar best suited to their purpose, and oreover the tar has been relieved of the constituents much eeded by the Ministry of Munitions for the service of the ountry. With the number of dehydration plants now in se in the gas-works of the country supplementing the lant at the tar distilleries, there is no question as to a ufficiency of the refined material, and at reasonable price. Vhat gas-works would certainly like now would be for e Road Board to do something in the way of advising ose road authorities who, in the mistaken belief that they re effecting economy, are neglecting the upkeep of roads rough relinquishing tar spraying, &c., to return to the eneficial work next year. If they do not, we can see bills r road repairs coming in in heavy lump sums later on. his is one of the cases in which too great an economy n be a real improvidence.

Fahrenheit and Centigrade.

Vhen writing last week of the disuniformity in the terms d conditions of the data presented in recent papers on tar hydration, reference was made among other points to the ct that there was variation in quoting temperatures in rms of the Fahrenheit and Centigrade scales. Upon this was remarked: "It is, of course, easy enough to convert from the one to the other for comparison purposes; but it is troublesome and a waste of time when the author could perform the service for all his readers. It would therefore be advantageous if authors would speak in degrees Fahrenheit in all communications on this subject." We have been ked why we suggested Fahrenheit, and not Centigrade. ersonally, we have no particular care in the matter, except at it is desirable to secure uniformity of expression upon ch an important point as temperatures so that comparison ay be facilitated. For all scientific and laboratory work, e Centigrade scale is employed. But it is not all men in e gas industry who have had experience of scientific and boratory work, and the majority always speak of temperares, and better realize them, in terms of the British adopted less convenient) Fahrenheit scale. This should be borne mind in dealing, in connection with the gas industry, with chnical matters where temperatures are involved. Many boratory workers appreciate the point, and invariably, while oting temperatures in degrees Centigrade, supplement the gures by supplying in parentheses the equivalents in Fahrheit. There is a growing disposition to give in published ork mixed terms and measures. This does not matter uch when chemists and scientific workers are speaking to, writing solely for, those who are able readily to grasp the lues. Workers in the laboratory tried to get, in connection ith the calorific power standard, the perpetuation of such mixed term as "calories per cubic foot" simply because "calories" were convenient for them and saved them a little trouble. Yet we have in existence the *British* thermal unit, which (this is said to make a point regarding Fahrenheit) is the amount of heat that will raise the temperature of 1 lb. of water 1° *Fahr.* It is better to legislate for the majority than for the few; and, B.Th.U. being the British adopted unit of heat, by some little perseverance we have it now (instead of calories) established in the calorific standard—the change from the hybrid term first adopted having been effected in the South Suburban Gas Company's Act of 1912. Then in connection with gas testings, corrections are made to 60° *Fahr.* and 30 in. bar. All low-temperature registrations on gas-works—at condensers, scrubbers, and station meter—are also made in degrees Fahrenheit. It would be possible to spin out a long case against ignoring in published work our adopted and recognized weights and measures and heat scale. But it is unnecessary to do so. When—if ever—a complete change is made to a more convenient and more widely utilized system of weights and measures, well and good; until then, and while our quantitative terms, whatever their kind, are appreciated by the greater number, then let us give that greater number the benefit of them. Meanwhile, we do not think any defence is needed to our plea for uniformity in methods of statement in technical papers. So far as the temperature scale employed is concerned, we have no particular care so long as there is uniformity, and heat quantities are so expressed as to be informative to the widest possible extent. Perhaps uniformity in this one matter upon which explanation has been sought would best be secured, and the greatest service rendered, by first quoting in Centigrade or Fahrenheit, and giving in parentheses the equivalents in the other scale.

From the Fatherland.

Evidence accrues that there are large numbers of German-made mantles, or mantles made by the aid of German capital and earning profits that find their way to this country, despite the war, through either neutral Continental countries or America, and that there are gas undertakings unpatriotic enough to buy the ill-disguised mantles rather than pay a small sum extra per gross to obtain British-made articles. The present condition of matters in this respect has caused Mr. F. D. Marshall to be reminiscent in a letter in our "Correspondence" columns. He writes feelingly, and justly so, as memory runs back to a pre-war effort in which he was concerned, to make a success of a British mantle-making business, but which met discouragement at every turn from gas undertakings, the mantle buyers of which preferred to patronize German enterprise, and to give greater happiness to the "happy Fatherland" by providing labour for it, in order to save 1s. per gross for articles that were no better in quality, in some cases of worse quality, than British-made ones. Even the company who supplied the mantle-making works in question with gas for the production of the mantles, and in whose district the factory operated, found the magnetism of the 1s. per gross saving too great for them. It is sickening. This country has been foolish in many things in connection with facilitating German displacement of our trade; and over this mantle-making business the British gas industry has ranked among the most foolish. There is now the well-known story of how Germany was allowed to get control of the monazite sands from Brazil, and how later it obtained the monopoly of use (through the General Electric Company of this country!) of the Travancore sands—sands from our own Indian possessions. And now that this country is safe in regard to monazite sands and thorium nitrate, through the agitation raised in our columns over this monstrous Travancore business, gas managements are still to be found who, for the sake of a small difference per gross, prefer to give business to others than British makers. By some of the buyers, too, no trouble is taken to try to ascertain whence the mantles originate, and to reject them if there is not satisfaction on the point. It is a miserable and not creditable business.

Coal Wages and—

Shadows of possible events are often cast in the columns of the "Iron and Coal Trades Review." An article appears in the current issue on "Coal Prices." It opens by admitting that market prices are practically at the highest limit allowable under the Coal Price Limitation Act, that the coal owners are still reluctant to accept the interpretation put by the Board of Trade on the term "corresponding price," and that the Act has "unquestionably had the effect of checking the tendency of inland prices to soar upwards indefinitely." But the miners are again restless on the subject of wages; and pitwood and other materials show no inclination to arrive at a state of repose in the matter of cost. A Coal Miners' Wages Limitation Act will next be required. The appetites of the miners and their families for food and holidays grow with the excellent wages the former are receiving. In the English Conciliation Board area, a further advance of 5 per cent. was granted last week. There would not have been this ready compliance, if the advance [we do not say whether or not it was justified] did not come within the capacity of the coal proprietors to pay it. But further demands are expected. The Scottish miners, too, are asking for an advance of 18¾ per cent.; and the Durham miners have been conceded 11¼ per cent. advance.

The Four Shilling Standard.

This brings us to the point of the article: "It would not be surprising, therefore, if collieries mainly dependent upon the inland trade, and whose output is sold subject to the Limitation Act, sought some relief by applying to the Board of Trade [under clause 2 of section 1 of the Act] for permission to charge more than an advance of 4s. per ton upon the 'corresponding price.'" This has already been done in the case of the Forest of Dean. But the Board of Trade must be satisfied, in respect of any class of coal mines, that, owing to special circumstances affecting these mines, the standard amount of 4s. should be increased. We imagine the Board will want very clear proof before so soon upsetting the 4s. standard. When this standard was settled upon, the President of the Board was convinced that it afforded a good margin over the actual increase of costs incurred through the war. Parliament never intended that extravagant demands by the miners, with the owners in apparently acquiescent mood, should provide a case for breaking down so promptly long-considered and much-discussed legislation—legislation which acted liberally to the coal proprietors, and placed a restraint upon excesses. The remark of the "Review," that the Act has "unquestionably had the effect of checking the tendency of inland prices to soar upwards indefinitely," was not a diplomatic one, as it shows the necessity and the justice of the Act.

A Canadian Report.

There will no doubt be general agreement with the Directors of the Consumers' Gas Company of Toronto, in their view that, considering the many adverse conditions which have surrounded all classes of public utility undertakings, a decrease of only just over 1 per cent. in receipts from gas values during the year ended Sept. 30 is satisfactory. Certainly, it will appear so to those who are aware of the fact that business depression has been responsible for the closing of thousands of buildings throughout the city. It is evident, in this connection, that what the Company lost in one direction they gained in another; for a substantial increase during the twelve months in the number of meters in use brought the total to the largest in the history of the undertaking. As is the case elsewhere, the popularity is growing in Toronto of the use of gas for cooking purposes; and the same remark applies to its employment for manufacturing. People in this country will share with those in Toronto the feeling of pride that so large a percentage of the Company's employees should have enlisted. Over 200 of them are numbered among the Canadians who have answered the country's call in the manner that we never doubted they would. They have left the Dominion to take their part in the world war; and the pity is so many of them will not return.

German Trade after the War.

There appears in the current issue of the "Board of Trade Journal," a useful translated summary of articles which have been published during the past twelve months, on the subject of the German iron and steel industries, in the "Kartell-Rundschau," of Dusseldorf. The proposed reorganization of the industries which is there discussed, affords evidence as to the amount of thought which is being bestowed in Germany upon the industrial position after the war. What manufacturers have been deliberating upon is a scheme having for its primary object the formation of Syndicates for the control of bar iron, sheets, tubes and pipes, &c., and an Association to fix the allotment figures. The fundamental principle underlying this particular plan—which is known as the "Muller scheme"—is an effective control of steel-pig; but at the same time the organization would "have to investigate the question whether, after the war, it would still be expedient to sell at low prices to the United Kingdom and Belgium large quantities of semi-manufactured material, or whether it would be preferable to convert this semi-manufactured material into finished products at their own works, and then export the same." A further object would be to improve the "somewhat niggardly methods" with which Syndicates have hitherto managed foreign trade. It is urged that after the war Syndicates will play an invaluable part, not only in the development of the iron and steel industries, but also in the whole economic development of Germany. In fact, the "Kartell" urges that "the important principle which should guide the industrial community when discussing the subject of Syndicates is: After the war, it will be necessary for Germany to face the question of developing its trade in foreign markets in the same effective way as the German military authorities are now confronting the situation abroad; and this can only be accomplished with the assistance of Syndicates." Though nothing definite seems yet to have been established in the way of forming a German Steel Federation on the lines laid down, there is little doubt that the movement will be kept alive; and the Board of Trade are doing good service in thus calling attention to what is "in the wind." English firms will be glad to know what they are likely to have to face, and should be able to take advantage of the knowledge.

The Working of Patents.

An unassuming but useful little Bill made rapid strides through the House of Commons last week—being read a second and third time, and passed, at one and the same sitting. It is entitled the Patents and Designs Act (Partial Suspension) Bill; and it has for its object to suspend during the continuance of the war, and for six months thereafter, the clause in the Act of 1907 which provides that any patent which is granted in this country can be revoked if within four years of the date on which it is granted the patentee does not manufacture or produce the protected article in this country. However desirable the stipulation may be in times of peace—and its wisdom has been recognized in other countries besides our own—it is obvious the application of the rule with the existing shortage of labour and materials, and Government control of workshops, might be hard on the inventor and prejudicial to the country. Therefore the Board of Trade have done well to introduce the Bill, so that no one can have his patent voided because he does not work it under war conditions. Not merely is the action of the clause referred to suspended, but it is provided that in reckoning the period of four years mentioned in the section, "the period during which that section is suspended by virtue of this Act shall not be taken into account." In France, they have dealt with this matter in a manner which might well be followed in this country, in various directions. What they have done is, as Sir Croydon Marks pointed out in the House, to grant to all patentees an exemption in respect of working patents in the country, provided that in the countries of the citizens of other countries who hold patents in France, similar rights are given to Frenchmen. In the course of the debate, a suggestion was put forward that the Bill should be made retrospective; but this was not acceded to, though it was admitted it might with advantage have been introduced at an earlier date.

Coal and Coke Exports.

The Board of Trade returns relating to the export of coal and coke for October show the greater rigidity that is being exercised in respect of overseas traffic in these commodities. During last month 3,530,546 tons of coal were exported, as compared with 6,739,473 tons in October, 1913; so the reduction was 3,208,927 tons. October, 1914, with an export of 3,944,497 tons, showed a reduction over the same month of 1913 of 2,794,976 tons. The exports in October, 1914, being 3,944,497 tons, and last month 3,530,546 tons, 413,951 tons less were sent from our shores, notwithstanding that France was a buyer of upwards of half a million tons more than in the months of October of 1913 and 1914. The actual figures were: October, 1913, France took 1,077,519 tons; October, 1914, 1,006,066 tons; and October, 1915, 1,602,306 tons. The quantity of coke allowed to be exported has receded somewhat. In October, 1913, the quantity was 150,955 tons; October, 1914, 150,879 tons; and October, 1915, 113,499 tons.

PERSONAL.

Among the nominations for election on the Council of the Royal ociety at the anniversary meeting on the 30th inst. are Professor RTHUR SMITHELLS, B.Sc., of Leeds, and Mr. DUGALD CLERK, Sc., this year's Chairman of the Council of the Society of Arts.

The gas industry will learn with regret that Mr. BALFOUR ROWNE, K.C., has intimated to a Parliamentary Committee that intends to retire from practice in the Committee Rooms of e House. For very many years Mr. Balfour Browne has held a ominent position in connection with gas legislation; and quite cently he was President of the Society of British Gas Industries.

Among the sick and wounded soldiers on board the ill-fated spital ship *Anglia*, which was sunk in the Channel by a mine, s Sergt.-Major HILTON FURNISS, of the 7th Battalion West ding Regiment (Colne Valley Territorials), son of Mr. John rniss, the Manager of the Slaithewaite Gas-Works. Sergt.-ajor Furniss was being invalided home sick, and was among the ved; being now in hospital at Leicester. The Sergeant-Major the third son of Mr. and Mrs. Furniss, and was assistant to father at the gas-works. He is 27 years of age.

OBITUARY.

The death occurred on Thursday last, at the age of 53 years, Mr. BENJAMIN WALKER, of Golcar, near Huddersfield, who was ief Clerk and Assistant Secretary of the Longwood Gas Com- ny. He was the oldest servant of the Company; having been their employment for 35 years. He leaves a widow, one son, d one daughter.

The death occurred very suddenly indeed from heart failure, Thursday afternoon last, of Mr. CHRISTOPHER WALLIS BOYNS, cretary and Manager to the Romford Gas and Coke Company, nited. Deceased, who was 54 years of age, had for some years n Secretary of the Company; and on the retirement recently Mr. W. D. Child he was appointed Manager as well as Secre- y. Mr. Boyns left the works shortly after mid-day on Thurs- apparently in good health, but on reaching home complained a pain in the region of the heart. He was assisted up to bed, died before a doctor arrived. Mr. Boyns, who was son-in-law Mr. Alfred Lass, leaves a widow and one daughter. He did d work for the Company, by whom, and by the townspeople erally, his loss will be much felt. The burial was arranged for lay, at Leigh-on-Sea.

The coal-tar dye industry owed much to Professor RAPHAEL LDOLA, D.Sc., LL.D., F.R.S., who died in London last Tues- , at the age of 66. For a period of about eight years, ending 885, he was engaged in the colour works at Hackney Wick of ssrs. Brooke, Simpson, and Spiller; and while there he made e important discoveries in connection with coal-tar dyes. In , he was said to be one of the few chemists in this country had practical experience in their manufacture. For many rs he had urged that chemical research was the principal g that was needed to develop the industry in this country, and its decline dated from the time when Continental manu- urers allied themselves with pure science while British manu- urers neglected it. Professor Meldola was appointed Chair- of the Advisory Council of British Dyes, Limited; and in nection with this undertaking he protested against the sub- nation of science to business. It was in order to become fessor of Chemistry at the Finsbury Technical College that eft the Hackney Wick firm. He had been President of the mical Society, the Society of Chemical Industry, and the itute of Chemistry.

he Eastbourne Gas Company sustained a severe loss last dnesday by the death, at the ripe age of 91, of their veteran irman, Dr. GEORGE AUGUSTUS JEFFERY, J.P., and by the e event there has been removed one of the most esteemed re- nts in the district. His wonderful record with the Company well known as his sterling qualities have been appreciated. as in 1857 that he was elected a Director; and three years he became Chairman. Prior to the illness a few months which has now terminated fatally, Dr. Jeffery, in the whole e 55 years during which he occupied the chair, never failed ttend a half-yearly meeting of shareholders. It will be re- d that Dr. and Mrs. Jeffery celebrated their Golden Wedding e early part of this year. Death took place at Hailsham, re for some years Dr. Jeffery had been living in retirement, his many years of great activity. In addition to his private tice, he was for some time one of the Medical Officers of the tbourne Union. Subsequently he was elected a member of Board of Guardians, and for several years officiated as Chair- . At one time, also, he was Chairman of the Eastbourne al Board, and upon the incorporation of the borough obtained at on the Town Council.

Limitation of Profits in Controlled Establishments.—The ister of Munitions has appointed Sir Henry Babington Smith irman), Mr. Harold Brown, and Mr. William Cash to be the rd of Referees for the purpose of carrying into effect section 5 e Munitions Act, relating to the limitation of the profits of rolled establishments.

WOMEN'S WORK.

FOR many kinds of exhibitions, the present would hardly be likely to be regarded as a suitable time; but obviously no doubt on this score could arise in the case of a display having for its title "Women and their Work," such as is now being held at the Prince's Skating Club, Knightsbridge, under the auspices of the "Daily Express." Women's work is to-day to be seen everywhere. New careers are opening up for them with almost bewildering rapidity. In fact, the war has given women such an opportunity as it would have taken them long to secure, by their own striving. And well, we know, are women acquitting themselves in numberless unaccustomed tasks hitherto regarded as man's privilege to perform. The Knightsbridge display, however, is intended to deal more particularly with the arts and crafts of the home-worker. These afford ample scope for a good exhibition; and the opportunities have been well taken advantage of. There are to be seen many things which some women can do; and some things which many women can do. Some things which excite admiration, because of their beauty; and others, because of their utility.

In the case of one stall, at any rate, the useful and the ornamental are combined in equal proportions. That is to say, there is a charming little exhibit by the Gas Light and Coke Company, for the arrangement of which, it is understood, Miss Edden, as the head of the Women's Advisory Section, is responsible. There is fitted up here one of the daintiest imaginable little invalid bedrooms, with an "all gas" kitchen to match, in which the nurse in attendance can do the cooking that may be required. The lighting is with inverted burners on the "Telephos" system; and in the bedroom there is a Davis "Adapta" fire, with artistic metal surround, and a gas sterilizer. In the kitchen, the main object of interest is one of Messrs. Fletcher, Russell, and Co.'s new externally heated cookers, with closed-in hot plate, an illustrated description of which will be found on another page of this issue. With this, tempting samples of invalid cookery are prepared—just those little things which demonstrate so conclusively the completeness of the control which the cook has over the cooker. Hot water is supplied to a lavatory basin, &c., by a geyser; and there is a gas-heated towel airer.

The stand attracts attention, as it deserves to do; and the goods shown induce inquiries. This part of the exhibition seems to have an air of cheerfulness, which is not everywhere observable. Other stalls are electrically lighted; and this may be the reason. Perhaps the incandescent gas is brighter; it certainly seems to serve better for colour matching—judging from the use that is said to be made of it for this purpose.

Swiss Coal Tar Dyes.

In a column of "Notes" in their last week's issue, "Engineering" wrote: Prior to Dec. 1, 1907, it was not possible to obtain a patent in Switzerland for a process. This was because the law in force before that date required that every invention should be capable of representation either by model or photograph. It was obviously impossible to represent a process by model or photograph; and consequently it was not possible to patent processes. As a result, the large German coal-tar dye firms were prevented from patenting their processes in Switzerland. Switzerland was therefore a free country, so far as patents relating to coal-tar dyes were concerned, and it was possible for Swiss manufacturers to take the various processes patented in Germany and other countries and market the products free of any patent royalties. Before the commencement of the present unfortunate situation in Europe, the Swiss dye manufacturers were receiving intermediate products from Germany for use in the manufacture of coal-tar dyes. When the German manufacturers were prevented from exporting their dyes abroad, they did not see why the Swiss dyeware manufacturers should have the market left to them, and the trade the Germans had carefully and laboriously built-up captured by a neutral nation at one swoop. Consequently, they refused to supply Swiss manufacturers with the intermediate products, in the hope of preventing delivery of finished products abroad. From information supplied, it would appear that the German manufacturers threatened such of their Swiss customers as employed special colours not manufactured in Switzerland with a refusal of supplies should their fellow-countrymen continue to supply the English market with colours made from English intermediate products. These threats, it seems, have had no effect; and, as a further step, the Germans have now been threatening to cut off the supplies of coal to Switzerland. Even if they did so, they will not be in a much better position; for it will still be possible for Switzerland to import the necessary coal and the intermediate products from this country.

Starred Trades.—An official list of starred trades, the workers in which are not to be recruited, has been issued. Nearly 350 occupations and sub-occupations are named. In the first list—occupations bearing on munitions—are included all workers in tar distilling; in coal mining, all workers below ground, and certain of those above. A note with regard to public utility services states that, in the case of the gas, electric light, and power corporations, water-works, tramways, and canals, skilled men, if attested, will not be called upon for actual service with the colours unless their employer states that their services can be spared.

STORAGE OF AMMONIACAL LIQUOR.

By W. S. Curphey, Chief Inspector of Alkali Works.

At a time when close attention is being directed to the need of conserving national resources and safeguarding against loss, more especially in the chemical industries, it will not be thought out of place, I hope, to draw the attention of manufacturers who handle ammoniacal liquor in sulphate of ammonia and other works to the serious loss of ammonia which is likely to occur when liquor is stored under conditions which admit of air circulation above the surface. Attention has frequently been called to the matter in the Technical Press; and the subject found mention in the annual report of the Chief Inspector of Alkali, &c., Works for 1910 and subsequent years. In the 1914 report (p. 17), the suggestion was made that a layer of suitable oil covering the surface of the liquor when in the storage tank might be found serviceable in preventing any loss of volatile ammonia; and it was further pointed out that oxidation changes which result in the formation of fixed salts of ammonia would at the same time be retarded, with an ultimate saving of lime or alkali in the "fixed" ammonia still.

During the present year opportunity has been found to submit the question to test. With the willing co-operation of the management, experiments on the storage of ammoniacal liquor have been carried out at five works. The results appear to show conclusively that a thin layer of oil is effective in reducing oxidation changes and loss of volatile ammonia to minimal proportions throughout prolonged periods of exposure. Liquor stored without such protection experiences loss, which increases with the freedom with which air is allowed to circulate above the surface. It is not possible for me, in a communication of this character, to present the whole of the experimenal data obtained (which, it is hoped, will be made public at a later date); but the following examples will sufficiently indicate the results obtained:

Works A.—*Liquor Stored in Rectangular Tank* (1000 *Gallons*) *with One Inch Air-Space between the Roof and Sides. Temperature of Liquor*, 57° *to* 73° *Fahr.*

At the start, free ammonia 1·149, fixed 0·323, total 1·472 grammes per 100 c.c.

Loss per 100 parts of free ammonia	1 day ..	2·9 per cent.	
	3 days ..	6·0 ,,	
	31 ,, ..	23·1 ,,	
Corrected for evaporation	80 ,, ..	43·2 ,,	(fixed 0·328).

Liquor stored as above with layer of oil 1¼ inches thick:

Loss per 100 parts of free ammonia (no evaporation)	80 days ..	0·5 per cent.	(fixed 0·327)

Works B.—*Cylindrical Boiler, placed Horizontally*, 6 *Feet Diameter*, 4 *Feet of Liquor. Manhole Area*, 0·87 *Square Foot, with Protection from Rain. Temperature of Liquor*, 70° *to* 75° *Fahr.*

At the start, free ammonia 1·497, fixed 0·351, total 1·848 grammes per 100 c.c.

Loss per 100 parts of free ammonia	7 days ..	3·0 per cent.	
	21 ,, ..	7·5 ,,	
Corrected for evaporation	79 ,, ..	20·8 ,,	(fixed 0·384)

Liquor stored as above with ⅕ inch layer of crude paraffin oil:

Loss per 100 parts of free ammonia (no evaporation)	79 days ..	0·4 per cent.	(fixed 0·352)

Works C.—*Iron Drum, Without Lid* (90 *Gallons*), *Stored Under Cover. Temperature of Liquor*, 46° *to* 57° *Fahr.*

At the start, free ammonia 1·356, fixed 0·193, total 1·549 grammes per 100 c.c.

Loss per 100 parts of free ammonia	16 days ..	11·0 per cent.	
Corrected for evaporation	92 ,, ..	38·7 ,,	(fixed 0·186)

Liquor stored as above with 0·7 inch of mineral oil (sp. gr. ·88 to ·89):

Loss per 100 parts of free ammonia (no evaporation)	92 days ..	0·5 per cent.	(fixed 0·187)

Liquor stored as above with 0·08 inch (2 mm.) of mineral oil:

Loss per 100 parts of free ammonia (no evaporation)	70 days ..	0·3 per cent.	

A layer of oil $\frac{1}{10}$ inch should therefore afford complete protection.

The importance of this matter has been forcibly brought home to me by more than one instance coming within my knowledge where distillation of gas liquor kept in prolonged storage during summer months resulted in no separation of crystals of sulphate of ammonia in the saturator in the ordinary course of working. This seemed to be due to the very small proportion of ammonia remaining in the liquor when distilled.

This possible source of loss should not be overlooked when comparing the direct with the ordinary method of sulphate of ammonia manufacture.

Nov. 19, 1915.

ELECTRICITY SUPPLY MEMORANDA.

Members of town councils must now exercise some discretion as to the terms in which they speak of the local gas supply during the war and for some months after. They must be most respectful in their demeanour towards, and utterances concerning, it, and must do all they can to counteract reflection, animadversion, and anything else that is disagreeably applied to the gas supply in regard to its quality. The reason is that those gas undertakings that are serving the country by extracting from gas and tar certain constituents which are doing inestimable duty in holding in safe check, in the destruction, and in the exhaustion of the enemy, are performing this special work at the request of the Ministry of Munitions (which request may develop into a demand if needs compel), and are therefore under their protection. The protection of the Ministry of Munitions is of a very substantial order; they having at their back the Defence of the Realms Act—an Act which appears to cover every offence imaginable or unimaginable which is detrimental to the work subscribing to a victorious issue to the war. Therefore, under present circumstances, municipal bodies must protect and not revile gas. There was the other day public reference, at a municipal council meeting, to the quality of the local gas since washing has been in progress to secure for the country one of its chief needs in connection with the war; and a member of the council said what was very indiscreet then, and would be more so to-day, as to people turning over to electricity if they were not pleased with the gas supply. That was very wrong. It was not patriotic. It was unjust to the gas undertaking. It was suggesting something detrimental to it—in other words, it was an attempt to incite people to punish the gas undertaking for carrying out its duty to the country. Since the remarks were made that municipal authority, among others, have no doubt received intimation that the publication of the results of gas testings are to be suspended and no penalties imposed while the gas undertakings are engaged in serving the nation in this particular way. The object of this is to do all possible to protect the businesses of gas undertakings from attack during the performance of exceptional service in the present grave period. It is, of course, the luminosity of the gas that suffers most under the process; the calorific power does not suffer to any material extent—in fact, experiments show that using unbenzolized washing oil, the percentage reduction in calorific power is only about 4·5 per cent., while with benzolized washing oil it is only about 0·6 per cent. With such slight effect resulting from the drastic treatment of unbenzolized wash oil, it is clear that, with the "C" process, the depreciation of the calorific power would be inappreciable to any consumer. This fact accounts for the complaint referred to being quite an isolated one.

In the Country's Service.

Anticipation and Realization.

The Point-Fives Association is an organism of slow growth. One more individual is required to make the membership comply with a solemn vow made at the time of the formation of the Association in 1912. The vow was registered in the Commercial Supplement of the "Electrician." It was to the effect that week by week the names of the members should be published until the number reached 24. For a long time the number has stuck fast at 23; and now it is acknowledged that there appears to be no immediate hope of bringing it up to the level two dozen. The vow is now declared off; and the names will not henceforth appear in the place that has weekly testified to an incapacity for expansion. Three years and some months, and still not 24 members, is a result of which the Association cannot be proud; and it is perhaps better the advertisement of the numerical failure should not be continued. There is something pharisaical about membership of the Association—membership proclaiming as loudly as anything can do: "Thank goodness we are not as other electrical men." There has been anything but consistency of opinion in the electrical profession as to the soundness of the aims and objects of the Association; and the view will be stronger still now that costs have gone up so heavily, and not likely to return to the old state for many a long year. The members who have essayed to place the principle and policy of their majority on a high peak have been much chagrined by their failure. It has been a dead-failure because, if anything, they have assisted in showing that justification for the system of charging a lump sum on the rateable value of premises, *plus* 0·5d. per unit, has no visibility even by the aid of a magnifying-glass. That is not the system adopted by all the members; but it is the one introduced by the majority. The roll of the twenty-three is as follows: Mr. J. Horace Bowden (Poplar) Mr. H. F. Street (Southampton), Mr. W. H. Cooke (Luton, Beds.) Mr. T. Rolls (Bradford), Mr. A. S. Blackman (Sunderland), Mr C. S. Davidson (Barnes), Mr. A. H. Seabrook (St. Marylebone) Mr. G. W. Spencer Hawes (Reading), Mr. J. W. Hame (York) Mr. S. T. Allen (Wolverhampton), Mr. F. W. Purse (Carlisle) Mr. W. G. Pickvance (Wrexham), Mr. H. Gray (Accrington) Mr. S. E. Fedden (Sheffield), Mr. J. W. Sparks (West Hartlepool) Mr. J. W. Beauchamp (West Ham), Mr. A. H. Shaw (Ilford), Mr C. Furness (Blackpool), Mr. C. M. Shaw (Worcester), Mr. H. A Nevill (Wakefield), Mr. Frank Ayton (Ipswich), Mr. C. N. Heffor (Leeds), and Mr. S. E. Britton (Chester).

Electric Fires.

Gas-fire makers inform us that it is safe to say, had it not been for the war, the gas-fire business this year would, the ndications show, have put into the shade the excellent showing f its predecessors. The writer of "Commercial Topics" in the Electrician" appears to suggest that the new bar electric-fires, hich are fearful gourmands in cold weather, are going off like ot cakes. We are amused at the slender character of the evi- ence of this that he presents. "There still seems to exist," he rites, "a little doubt as to what shall be the standard loading of e fire-bar units; but it is interesting to note that several manu- acturers have definitely pinned their faith either to the ½ KW. or e 1 KW. bar. This in itself is noteworthy, because it indicates that e fires are being made in considerable quantities—a fact which a sure index of the public demand." The logic of the statement remarkable. Because makers had to fix on a bar-loading of me amount, and took the very natural units of ½ KW. or 1 KW., is is regarded as an indication that the fires are being made in nsiderable quantities. This is wonderful; and it is still more onderful that such an indication should be "a fact which is a re index of the stability of the public demand." Following ese sapient statements, there is this breezy assertion: "In spite the increase in the charges for electrical energy . . . the ectric-fire is increasing in popularity. Up to the present, it has t been found necessary to undertake anything in the nature of newspaper advertising campaign; the fires practically sell, or are red, at sight when displayed in the showrooms of central station gineers or contractors." We know of central station engineers ho could not endorse the assertion. Some of them can tell how e running expense of electric-fires has caused the return of many hire, and how the increase in the price of electrical energy s not inured to the maintenance of connections. Gas salesmen, o, have, much to their distress—distress occasioned by con- deration for the feelings of central station engineers—had to help evict electric-fires in order to put more thermal power, at a more asonable price, at the disposal of the users. But the distress s been ameliorated by the knowledge that the change has been e means of giving considerable happiness to those who have en the last of the wasteful electric-fire.

A Melancholy Procession.

This reference to the eviction of electric-fires renders appropriate an allusion to a statement recently made by Mr. Nichols Moore, the Corporation Electrical Engi- eer of Newport, Mon. It occurred in a letter to "Electrical ngineering," and intimated there was something of a mono- nous regularity about the way that electric-motors were in his wn sending gas-engines along to the scrap-heap. The melan- oly procession exists in imagination, not in actuality. There no doubt that Mr. Moore is occasionally introducing a motor place of an obsolete gas-engine. The Gas Company themselves much the same work—remove a good many obsolete engines, d replace them with modern types; and, as a matter of fact, ere has been an increase in the total number fixed in the town. r. Thomas Canning is not likely to see his power business hittled away, as Mr. Moore suggests is being done, when there is occasion for it. The gas-engine of to-day is not the engine of e past; but gas managers find it difficult to get a user to give up nning a gas-engine so long as the wheel will go round.

Cottage "Lighting."

Some time ago, it was announced that an experiment was to be made with the electric lighting of a group of cottages at over. The Borough Electrical Engineer has now reported on e first year's experience; but he does not give any information to whether the poor occupants of the cottages could see with e lamps with which he provided them, nor does he say whether ey had to have any supplementary means of lighting for some the rooms. A similar experiment in which we had an oppor- nity of being interested at one time ended in utter failure, through e use of too small lights, and the trouble there was with the stallation when the newness had worn off. There was always mething going wrong with switches, wiring, and lamps. The rporation Electricity Department got so thoroughly sick of the hole business that they did not go beyond the experiment, and ost of those houses are now equipped with gas-fittings of the candescent type, which was a simple matter, seeing that in them s-cookers were in regular use. But about this Dover experiment ith twelve cottages. In Nos. 9 to 12 the supply was not in com- ete use until August, 1914; but the period covered by the report the case of the other houses is the twelve months to the end of ne. The results were: Nos. 1 to 4: Units, 269; receipts, £5 17s.; erage price per unit, 5·219d.; Nos. 5 to 8: Units, 287; receipts, 5 5s. 6d.; average price per unit, 4·411d.; Nos. 9 to 12 (incom- ete year): Units, 193; receipts, £4 16s. 6d.; average price per it, 6d. Total units, 749; total receipts, £15 19s.; average price r unit, 5·11d. It will be observed that Nos. 5 to 8 got 18 units ore than Nos. 1 to 4; and yet paid 11s. 6d. less. It will also be ted that the consumption of the first four houses only averages ¼ units a year, which, taking the light and dark weeks of the ar together, averages 1·3 units per week; so that the quan- y of light these people had could not have erred on the side of travagance. The cost of the lamp renewals at 1s. 5¾d. apiece ows that the lamps were not of magnificent candle power; but, ere being nineteen renewals of lamps, the cost was £1 8s. 1¼d. Deducting the cost of the lamp renewals from the receipts, the net receipts amounted to £14 11s. for 749 units, or 4·66d. per unit. The capital charges on the works plant and service-line costs were represented by the sums of £4 12s. and 11s. 9d., respectively, per annum, or a total of £5 3s. 9d., which, for a completed year's consumption of (say) eight units in excess of the 749 units actually registered (having regard to the fact that the third block of cottages was not fully occupied until the first week in August, 1914) represented 1·64d. per unit. The total costs, including capital charges, were 3·39d. per unit; and the net receipts, being 4·66d. per unit, give a "net" profit of 1·27d. The difference between 1·64d. and the total costs of 3·39d. is 1·75d. Does this difference include all charges—generating, attendance, clerical work, collection, &c.? We should like to see the details, and a continuation of them as time progresses. On the Engineer's own showing, there is not much in the scheme for the Electricity Department; and there certainly is less in it for the occupants of these cottages. Take the first four cottages, the average of 67¼ units represents 53,800 candle-hours, giving the lamps credit for an efficiency of 1-candle power per 1·25 watts. The £1 9s. 3d. paid would purchase 9756 cubic feet of gas, which, with inverted lamps giving only 20 candles per cubic foot, would provide 195,120 candle-hours. The tenants of the cottages are not buying light in the cheapest market.

Electric-Furnaces for Metal Work.

Recently there have appeared in the "JOURNAL" two papers by Professor A. H. White and certain collaborators on the use of gas for metal work; and we should advise our electrical friends to read the papers in order to obtain an insight into the causes which have raised the gas-furnace into immense popularity among metallurgists. The papers will do them good instructively, as will also the Society of Arts paper in the forepart of this year by Mr. H. M. Thornton; and they will further prevent them going astray too much in placing an undue confidence in electricity making large progress in this direction. Papers on the electric-furnace have lately appeared from American sources in the "Electrician;" and if our friends will study one of them by Mr. T. F. Baily, and consider simultaneously what a kilowatt-hour represents thermally, as well as some of the figures given as to heat losses with electric-furnaces, it will be seen what thermally an inefficient system electric heating is. If, too, the papers by Professor White are adequately studied, it will be still further ascertained that heat is not the only consideration in producing good results in such processes (say) as case-hardening. One of the valuable effects of gas was shown by us on p. 305 of the "JOURNAL" for Nov. 9. The survey made in the electrical papers is not comprehensive on all points; and that by Mr. Baily certainly generalizes too much without taking into account factors that are present with gas treatment and not with electrical treatment. But the author, as a matter of fact, appears to be a little shy of gas-heated furnaces, and apparently, and very wrongly, he lumps them together with other furnaces of the combustion type. There is as much difference between gas-heated furnaces and solid or liquid fuel furnaces as there is between the latter and those of the electric type. We have, for instance, Mr. Baily intimating that the ordinary combustion type of furnace is not easy to control; and therefore there is a good deal of uncertainty in repeating results. Admitted, if the gas-furnace is excluded. But among the explanations of the popularity of gas-furnaces have been their controllability and the precision of result. Yet it is on the controllability that so much reliance is placed as a consideration to set against the higher costs of the electric-furnace. The author states, for example, that, in some operations, the actual cost of heating per ton is less with electric-furnaces than with combustion furnaces, while in some heat treating and annealing operations the precision with which the operations are carried out must be the justification for the higher cost of heating in the electric-furnace. In a general way, it is said the higher the temperature the higher the relative economy in the use of electric-furnaces. At the lower temperatures, there is less difference in the thermal efficiency of electric and combustion furnaces; but the electric-furnace shows great superiority in the way of temperature control. That is what is said. Then the non-oxidizing atmosphere is put forward as another advantage. The efficiencies of electric-furnaces, it is also stated, vary greatly with the size and capacity in tons per hour. The wall loss on a forging furnace of 60 KW. capacity heating 250 lbs. of steel per hour to 2200° Fahr. will be approximately 30 KW., showing a thermal efficiency of 50 per cent. A furnace of 1 ton per hour capacity for 2200° will show an efficiency of 75 per cent. In annealing work a furnace of 100 KW. per hour capacity will heat 600 lbs. of metal to 1650° with an efficiency of 50 per cent., while a furnace of 600 KW. capacity heating 3 tons of steel per hour will show an efficiency as high as 90 per cent. The statements generally are interesting; but they do not satisfy.

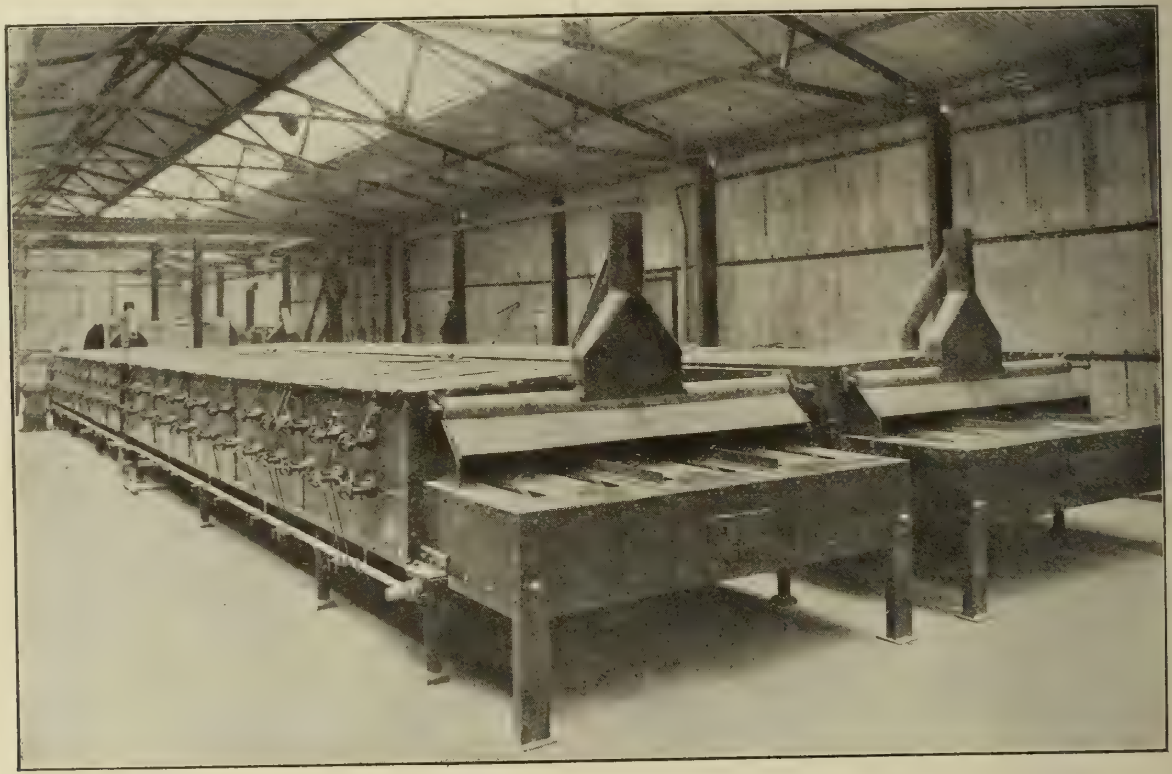
Yorkshire Junior Gas Association.—The annual meeting of the Association will take place at Leeds, on Saturday, the 4th prox. Members will assemble at the Meadow Lane Gas-Works, where, by permission of Mr. W. B. Leech (the Gas Engineer), the formal business will be transacted. After this, there will be an inspection of the works and the Dewsbury Road station. They will thus see, among other things, settings of intermittent vertical retorts, both completed and in course of construction, inclined retorts, a telpher plant, and the receiving station for coke-oven gas.

BISCUIT BAKING REVOLUTIONIZED.

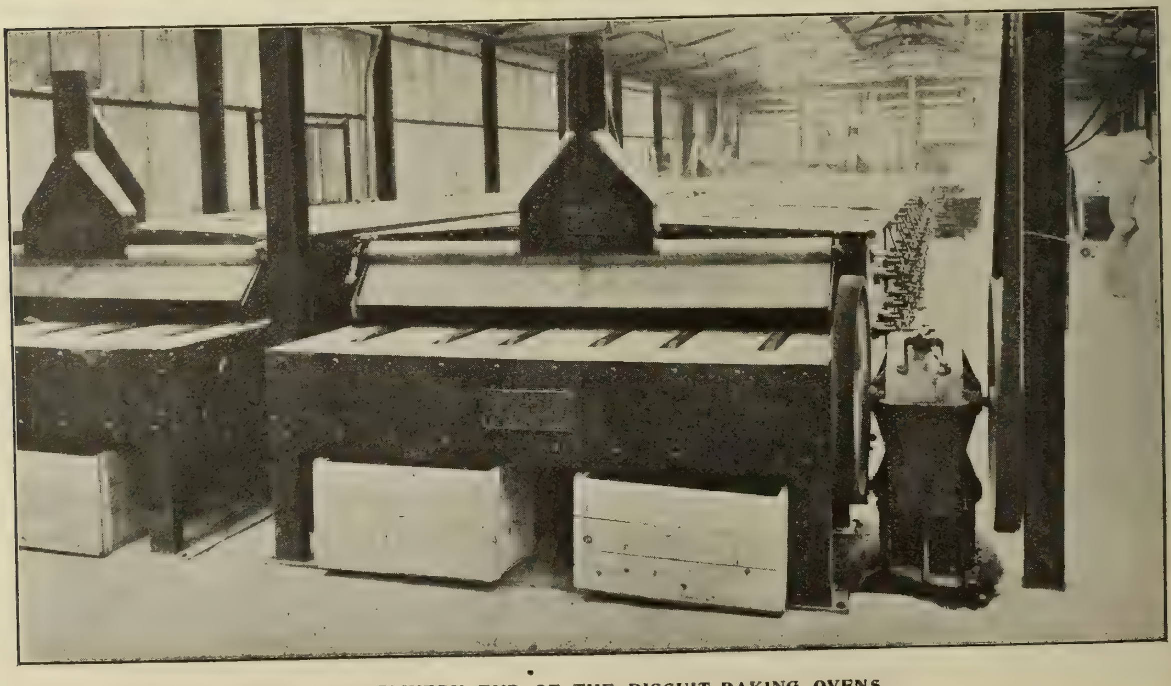
Gaseous versus Solid Fuel—the "B. K. B." System.

On several occasions of late, the columns of the "Journal" have borne witness to the large opportunities that have been presented to gas for use as a heating agent in connection with the manufacture of munitions of war; and for some undertakings the provision of gas for these purposes has been very welcome, on account of the temporary recession of business owing to the lighting restrictions, while for others the demand for munition work has been so great that the managers have had impressed upon them the meaning in full of *embarras de richesses*. However, this cannot be helped; and the awkward position has to be encountered. Of no less importance than the manufacture of war munitions is the question of the supply of food to the Army and Navy; and, in the cooking of food for our gallant fellows, gas is taking a large part, and brains have been busy devising acceptable means whereby that part may be largely extended.

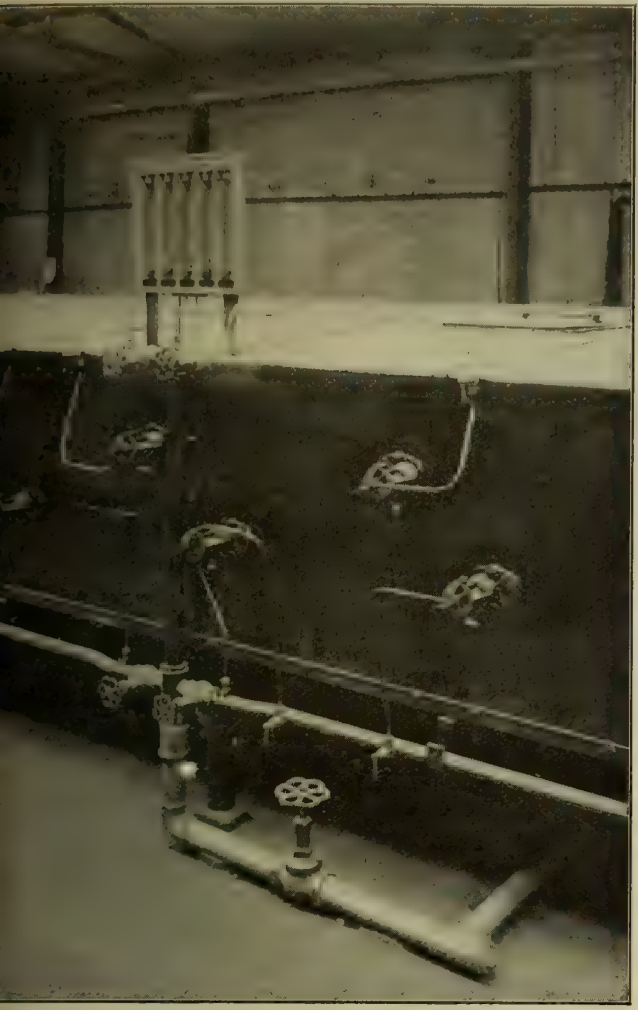
In connection with the biscuit-baking industry, we are to-day able to publish particulars of an innovation in which gaseous fuel has replaced solid fuel with such excellent results that it may be described as another triumph for gas And it must be admitted that the change is one of no meagre importance to gas undertakings with biscuit-producing establishments within their areas of supply. The importance lies in the facts that the operations mean a considerable, constant dayload for gas; and once the change is effected the several advantages ensure the business being of a permanent character. For the particulars of this new system of application of gas to such a substantial industry as biscuit manufacture, we are indebted to the James Keith and Blackman Company, Limited, the well-known high-pressure gas engineers. The firm have been working in collaboration with Messrs. Joseph Baker and Sons, Limited, Biscuit Machinery Manufacturers, of Willesden; and they have just produced a gas-fired travelling biscuit oven of novel design. Not only is it novel, but its efficiency is such that already several of the most important biscuit manufacturers of the country have made an initial installation of the ovens, with pleasing results. These ovens came at the right moment. A tremendous call has been made on the biscuit trade since the war started, for biscuits for both Army and Navy; and so with their resources taxed to the utmost, the manufacturers hailed these time-economizing ovens with great satisfaction, for by their aid pressure was quickly relieved.



THE FEED END OF THE TWO BISCUIT-BAKING OVENS—SHOWING THE BATTERY OF BURNERS.



THE DELIVERY END OF THE BISCUIT-BAKING OVENS.



E VIEW SHOWING THE DISPOSITION OF THE GAS-BURNERS, WITH GAUGES AND CONTROLS.

The illustrations show three views of one installation of two ens installed in the London district, which installation is in ocess of being duplicated. No better statement than this could ssibly be made to accentuate the satisfaction resulting from perience.

At the moment we cannot give particulars of the construction the ovens, inasmuch as several features are the subject of tent applications. But it will be readily seen from the illustrans how greatly these ovens differ from the hitherto recognized ndard travelling brick solid-fuel ovens. With the latter probly some readers will be familiar. They are built of special cks, having walls and crowns 3 feet thick, with flues, and underound furnaces. They monopolize a very large space on two ors—usually the ground and basement—and constitute a pernent and expensive building.

In the Baker-Keith ovens, high-pressure gas is the heating ent; and the biscuits travel through the ovens on chain conrors between the two rows of burners, as shown in the illustran. The simple and easy control of the heat which gas-firing ures is a marked feature of the ovens, and one which biscuit nufacturers have quickly appreciated. Instancing time-saving d control, it is found possible to start baking in about half an ur after lighting-up; and the heat can be regulated in any ection—top or bottom, delivery or feed end—by the controls ovided. This is undeniably a great advance on the old methods, ere continuous firing had to be kept up over-night and during ek-ends to ensure the retention of heat, and to enable baking to nmence in reasonable time in the mornings. Different biscuits, , require different temperatures; and, with the gas-fired ovens, iation to the desired temperature can be attained in a few nutes by the manipulation of the high-pressure gas-burners. us the saving of time is enormous compared with the waiting ocess necessary when, in the case of the brick solid-fuel ovens, ner more or less heat was required. As long as twenty-four urs is sometimes necessary to allow changes of baking with latter type of ovens.

Gas-firing does away with solid fuel, and the labour attaching the carting and storage of the latter, and to the stoking of fires. This is a very considerable item. Further the cleaness of gas-firing compared with the handling of solid fuel is a y important point.

t is not claimed for the gas-ovens that any direct saving is cted on fuel alone; but indirectly, bearing in mind the points advantage—the saving in labour, the quick control of heat, the ater and continuous output (which means increased works' acity without extensions), &c.—there is no doubt that the new ker-Keith ovens will very considerably reduce the cost of cuit manufacture.

Another point worth mentioning is the smaller area the gas-ovens occupy compared with the brick ovens, thus resulting in economy of floor-space. The new ovens, needing no underground furnaces, can be installed on any floor, and are semi-portable; so that their location is merely a matter of works' convenience.

The ovens are fitted with the Keith patent burners and injectors; and the gas is compressed in the well-known Keith patent rotary compressor.

This is as far as we may go in description at present. But sufficient has been said to show that there is here a fresh and successful application of gas which will be of advantage to the gas industry, particularly in those areas where biscuit manufactories already exist. Gas managers in such districts will not be slow in getting into communication with the James Keith and Blackman Company, in order to make themselves fully conversant with the details of the new system, so as to be able to approach with confidence the owners of biscuit manufactories. There is in this fresh introduction an economic proposition which those concerned cannot afford to ignore.

THE RECENT GAS-FITTING EXAMINATIONS.

Report by the Examiners on the Written Papers.

In connection with this year's examinations in "Gas-Fitting" by the City and Guilds of London Institute, a detailed report on the written papers of candidates has been prepared by the Examiners (Mr. H. Kendrick and Mr. R. Halkett) and submitted by them to the Institution of Gas Engineers. The Institute have assented to the request of the Institution to publish this report—which appears below—so that teachers of gas-fitting may be able to see the nature of the mistakes most commonly made by candidates at the recent examinations. In sending out copies of the report on behalf of the Institute, Mr. Leonard G. Killby remarks that, as regards the practical tests, these were intentionally of a simple character this year, when the examination was held for the first time; but the teacher should be informed that next year they will be somewhat more severe, and that the standard of the test in Grade II. will approximate to that of the final test set at the examinations of 1915. All the candidates will, in addition, be examined *vivâ voce* by the Local Examiner, and marks will be awarded for the answers given. These will be taken into account in the Local Examiner's awards. In each of the written papers, three obligatory questions will be set, which candidates will be required to answer to the satisfaction of the Examiners, in order to secure a pass.

Grade I.

Question 1.—How many types of gas-meters are there, and why are they so called? What are the measuring chambers made of in each case? (40 marks.)

A large percentage of the candidates did not know what was meant by type of meter, nor anything about the construction of either dry or wet meters. Teachers must explain only two types of meters (wet and dry), and thoroughly explain from actual meters that can be taken apart the interior parts and mechanism of all kinds of meters.

Question 2.—Give the difficulties to be contended with when fixing a gas-meter. State how you would overcome them. (50.)

Many candidates thought of difficulties with space only, and comparatively few made provision for syphons on the outlet of dry meters. The other difficulties met with, such as accessibility, dry situation, and unexposed position, were generally understood.

Question 3.—Which do you prefer for gas-fitting—malleable wrought-iron pipe or barrel, lead pipe, or compo. pipe? Give your reasons. (40.)

This question was answered generally from one point of view only. Comparatively few put the advantages and disadvantages of iron *versus* lead or compo. pipes, which obviously was what was wanted.

Question 4.—State step-by-step how you would proceed to make an upright joint and a tee joint with two pieces of compo. or lead pipe. What would be the effect on the flow of gas of a badly-made joint? (50.)

Answered by most of the practical candidates well and fully. There were a considerable number, however, who left too much to the imagination of the examiner—the answers lacking detail. This type of question (and, in fact, all questions) should be answered fully, as if the examiner knew nothing about the subject.

Question 5.—Give a list of the principal tools used by a gas-fitter. (55.)

Answered generally fully; but few of the candidates thought it necessary to carry a spirit-level in their kit, and fewer still a pressure-gauge. We should call these both essential to a first-class gas-fitter.

Question 6.—Give a list of the various gas-burners in general use. (40.)

By this question was meant lighting burners. A large proportion of the candidates included gas fire and cooking and heating burners in the list. Had these been suggested, they would have been specified. Many of the lists given were quite complete, but many exceedingly poor—many candidates evidently not having heard of the Welsbach-Kern burner, or Bray's adjustable flat-flame, and confining their answers to short lists that were evidently of local use only. The list should have comprised typical burners in flat-flame, "C," inverted of the best known and standard makers, and excluded comparatively little-known burners of only local fame.

Question 7.—Give a general description of a first-grade cooker, describing all working parts. (50.)

Generally answered exceedingly well; but a great many candidates, when referring to the flue, overlooked the ventilating space between the inner and outer crown plates, which is frequently a source of trouble, and forgot to provide the cooker they were describing with a tap-rail and taps.

Question 8.—Why is it necessary to fix gas and air adjusters on gas-heating appliances? (45.)

Not generally understood. Very few candidates stated the main reasons due to inequality of pressure and quality of gas in various towns and districts, but most stated they were necessary to produce maximum heating effect only.

Question 9.—How is "gas-pressure" usually stated, and what is meant by it? (50.)

Not understood at all. Only one candidate stated that the pressure was caused by the holders forcing the gas through the street-mains. Very few described the pressure-gauge, and quite a considerable number failed to quote "tenths and inches" as the usual method of stating gas pressures. Many went into high-pressure figures, quoting inches of mercury and pounds per square inch, which are not the usual methods of every-day practice.

Grade II.

Question 1.—Describe the construction of a dry meter and a wet meter. State which you prefer, and give your reasons. (50 marks.)

When attempted, the construction was fairly well answered. Only a few were fully acquainted with the details either of wet or dry meters, and teachers must thoroughly explain construction, as suggested for Grade I. Reasons given for preferring wet or dry meters were generally one-sided; very few putting the advantages and disadvantages of each type, the main objection to wet meters being stated as watering, while nearly all omit to mention the greater liability of errors in registration by the dry meter.

Question 2.—Does the area of a pipe affect its delivery capacity? If so, how. (40.)

Most candidates have an idea that pipe-areas and discharges have some relation, and that the length of same will affect their delivery capacity; but nearly all appear ignorant of the law and principles regulating their capacity.

Question 3.—What effect has (*a*) a flat place in a lead pipe, (*b*) a bend, (*c*) an elbow, on the flow of gas through a pipe? Which has least effect, and why? (50.)

The effect of construction and change of direction in flow was generally understood; but the reasons for reduced delivery and effect of friction were rarely given, and apparently not understood.

Question 4.—It is found that the oven burners of a cooker go out. State the reasons for the defect, and how you would remedy it. What pressure is essential for the satisfactory working of a cooker? (45.)

Some good answers; but the majority dealt with flue and ventilation only, omitting the defects arising from the crown space, burners, &c. The idea of pressure necessary varies from 15-10ths to 40-10ths.

Question 5.—Give sketches and describe the uses of the principal tools used by gas-fitters in their daily work. (55.)

Description of tools generally good, but sketches as a rule poor, with a few exceptionally good ones. A considerable proportion describe only a portion of the tools required; and nearly all omit spirit-level and pressure-gauge.

Question 6.—Describe an adjustable inverted burner. What is the effect on the light obtainable of (*a*) an excess of air, (*b*) an insufficient supply of air? (50.)

Description and sketches generally very poor. Candidates require more practice at this work. They should be made to sketch burner parts, and then the whole burner. The answers on air supply to burners were generally very good, and fairly well understood by the majority.

Question 7.—When fixing a gas-fire, how would you determine when it was necessary to fix a flue-pipe, and the length required? (45.)

Answers generally very good. All candidates state that it is necessary to fix flues, even with modern fires, to ensure no fumes in the room.

Question 8.—What is necessary to increase the temperature of a bunsen flame? (50.)

Very few understood the proportioning of air and gas, and the effect of varying mixtures.

Question 9.—Why are chimneys used with "C" incandescent gas-burners? Do they cause an increase or diminution in the quantity of light given out? Give your reasons. (45.)

Generally poorly answered. A limited number answered correctly; but the remainder were quite at sea, and generally thought the result would be a diminution instead of an increase in the light emitted when chimneys are used on "C" burners.

Final Examination.

Question 1.—How many burners would you allow to be supplied from a 20-foot length of each of the following sizes of pipes: $\frac{1}{4}$ inch, $\frac{1}{2}$ inch, 1 inch, $1\frac{1}{2}$ inch? Would you make any difference in the allowance for shops or private houses? If so, why? (50 marks.)

Very few answered correctly, generally overstating the capacity of $\frac{1}{4}$ inch and understating that of 1 and $1\frac{1}{2}$ inch pipes; and there appeared to be considerable confusion between lead and iron pipes' sizes. Only a few would make an allowance from the standard for shop lighting, and still fewer gave their reasons for so doing.

Question 2.—How would you test house pipes and fittings for soundness? Describe the apparatus you would use. (60.)

The answers indicated confusion in testing piping in a building before the fittings were fixed, and in testing pipes and fittings after completion. The water-gauge was the apparatus most frequently suggested for use; but a few said they would use a pump and a dial-gauge, and a few suggested a leakage indicator. A description of the apparatus used was only attempted in a few cases, and was in most cases poor.

Question 3.—What effect has the colour of gas globes and walls of a room on the illumination? Place the following in order of least interference: Red, clear, opal, pale green, opalescent, frosted, etched. (50.)

Answers generally very poor; all but a few having only a hazy idea of the effect of reflection from walls, and nearly everyone incorrectly stating the order of least interference.

Question 4.—A consumer sends in a complaint of defective supply. How would you localize it and deal with it, if it proved to be due to either a stoppage in the service-pipe or internal pipes, a defective meter, or defective burners? (60.)

The methods of most are effectual, but exceedingly slow; very few considering the use of the pressure-gauge until after they had exhausted every other means of locating a fault. If the pressure-gauge is used first with all apparatus in use, fault can generally be located to the service-pipe, meter, or one section of fittings within a few minutes, and much time saved accordingly. The description of burner-cleaning and maintenance was in most cases very poor, and indicates want of knowledge of the details.

Question 5.—Give a sketch of a high-power low-pressure outside lamp with which you are familiar, and state the utility of each part. (45.)

A few exceedingly good answers; but the majority very poor in sketches and description, apparently being unacquainted with the working details.

Question 6.—When fixing a gas-circulator to an existing hot-water installation, what precautions would you take to ensure satisfactory working? (50.)

Very little knowledge of the principles of hot water. Not one paper dealt with the subject in detail. Few dealt with such matters as faulty water connections, advantages of connecting direct to the cylinder, the position to place the pipes, inter-circulation if existing installation was unsatisfactory, and precautions to be observed when fixing flues to circulator.

Question 7.—Describe two systems of distance lighting for private houses. (40.)

Pneumatic and "Norwich" switches very well described, but the "Telephos" and Sugg's not generally understood, especially as regards the rotation of the ratchet-wheel under the influence of the electric current.

Question 8.—Why is a gas-bag used on a gas-engine supply? Describe the working, and give a sketch of same. (40.)

The gas-bag for engines was generally sketched and described very well. But the effect of oscillation (when the bag is not fixed) on the main and supply of neighbours was not generally given. Often stated to be necessary to protect meter only.

Question 9.—What is convected and radiant heat? Explain the relative value of each. (45.)

Only a small proportion of the candidates attempted this question; but the answers were good, and showed a sound knowledge of the laws of convection and radiation.

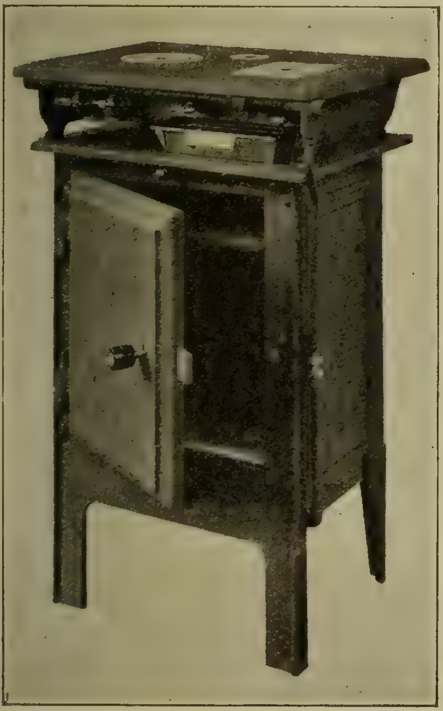
Mounting and Illumination of Barometers.—This was the subject of a paper read before the Royal Meteorological Society on the 17th inst., by Mr. J. S. Dines, M.A., describing the plan adopted at the Meteorological Office, South Farnborough. This consists in hanging the barometer against the window, with a thin wooden screen, 6 inches wide, placed behind it, about 1 inch from the tube. In the screen a narrow slit is made, $\frac{3}{4}$ inch wide, which comes immediately behind the top of the mercury column, and admits light from the window. The opening in the screen is covered with a piece of ground glass or thin paper, which prevents the passage of direct sunlight and gives a diffused illumination under all circumstances. Another feature of the mounting is the clamping of the bottom of the tube, as was generally done in the case of instruments of the Fortin type, in order to prevent any swinging of the barometer. The paper also contained an account of several sets of comparative readings of the barometer taken by different observers and between different types of instruments, which showed a remarkably close agreement with one another. The prevalent habit of tapping the instrument before reading was, the author said, not considered desirable.

AN EXTERNALLY HEATED GAS-OVEN FOR DOMESTIC USE.

The "1915" Cooker.

Not for the first time, Miss Helen Edden, the chief cookery lecturer and demonstrator of the Gas Light and Coke Company, appears in the *rôle* of a designer of gas-cookers; and no one could appreciate better than she the practical requirements of such an essential adjunct to the household. Her latest design of domestic cooker is being manufactured and marketed by Messrs. Fletcher, Russell, and Co., Limited; and it is of the type in which the oven s externally heated, with special attention given to the production of a good economy.

There are people who prefer externally heated ovens. They have some notion that the products of the combustion of gas—he carbonic acid and the water vapour—are poisonous, and have, when combustion proceeds inside a ventilated oven, some dele- erious effect upon the food. The same people have not the slightest objection to drinking mineral waters containing carbonic acid, or to sitting in crowded ill-ventilated rooms in which the contaminated air contains a good proportion of carbonic acid rom the lungs of the occupants. However, these people must have their whims and fancies catered for; and our electrical competitors have not hesitated to stimulate such whims and ancies in trying to make out a good case for the use of the elec- ric-oven. A cooker such as the one now under notice at once



The Edden ("1915") Externally-Heated Gas-Oven.

uts adrift all the argument that the electric people advance to lay upon the sensitive feelings of those who entertain a belief in l sorts of evil arising from cooking food in an atmosphere con- ining a larger proportion than usual of carbonic acid and water apour. The facts that gas-cookers may be counted by the illion with internal combustion for oven heating, and that we ave been able to raise an Army and Navy which are the admira- on of the world, and most of the units of which have been rought up, and are now fed on, gas-cooked food, are not known o those who suffer from imaginings such as have been referred o, or, if known, are not appreciated as testimony to the ground- ssness of their fears.

But in this oven and its hot-plate, Miss Edden has gone beyond erely catering for these people. She has sought to raise the conomy of the gas-cooker, while giving an enclosed oven; so at if a consumer is attracted by the idea of the electric-oven, e gas salesman can say: "Here is a gas-cooker with external eating; it is initially much cheaper than any electric-cooker on e market; and the running costs will be, for a corresponding mount of work, much lower than that of any electric-cooker." his is an important consideration in these days when economy not only preached, but is practised, and in many cases com- ulsorily so; and it will always be an important consideration where conomy is regarded as a virtue. The photographic illustration ows the appearance of the oven, which is on legs. The advan- ge of the oven being raised off the floor in the matter of facili- ting cleanliness is obvious. The body of the cooker is double ased—cast iron outside, while the oven itself is of sheet iron. he burners are arranged on either side at the bottom of the ven, which has a brick floor. The heat passes up the hollow space formed by the interior oven and the cast-iron exterior, and so keeps the oven in a jacket of heat, the degree of which, of course, varies with the quantity of gas consumed. There is no ventilation space from the oven in the ordinary way, but merely a few apertures, which Miss Edden's experience warrants her in saying are ample for all purposes of ventilation. The over-all measurements of the cooker are: 24½ inches wide, 37 inches high, 17 inches deep. The inside dimensions of the oven are 14 inches wide, 17 inches high, and 13½ inches deep.

From the illustration the novel construction of the hot-plate will be noted. It is a level, closed-in top, just like an ordinary coal range. There are two boiling-burners and a grilling-burner, and these are fitted with rings and cups, so as to accommodate any size of saucepan or of kettle. This construction of hot-plate ensures heat economy. Instead of the heat being allowed free escape all round the vessel being heated, there is a minimum of lateral escape; and the top of the hot-plate gets heated, and use can be made of the heated surface for a variety of operations. In other words, this top construction increases the capacity of the hot-plate in relation to the consumption of gas.

The cooker is a smart looking one. Apart from design, it has in it the excellent work of Messrs. Fletcher, Russell, and Co., which alone is a recommendation. But the details, the working capacity, the economy, and other points about the cooker are such that we have here something which is well worth consideration by the managers of gas undertakings.

ENGLISH AND GERMAN METHODS CONTRASTED

Many facts worth the careful consideration of Britishers who are prone to over-estimate the achievements of the Germans, and to depreciate the efforts of their own countrymen, were pointed out by Mr. Dugald Clerk, D.Sc., F.R.S., in the course of his address last Wednesday afternoon, in the capacity of Chairman of the Council of the Royal Society of Arts. Viewing the question from various standpoints, he made a vigorous and logical defence of the position of this country, in contrasting English and German methods. Quotations were given to show that engineers, chemists, literary men, and others had protested the inferiority of our own methods and the superiority of those of the Germans; and then there was presented the other side of the shield, which was obviously to the liking of the audience.

The truth was admitted—to give only two examples—of the fact that the Germans now manufacture more steel per annum than we do, and that they supply us with dyes for use in our textile industries. But, argued Mr. Dugald Clerk, it is misleading to cite the relative production of pig iron and steel as proving either the prosperity of Germany or the decadence of England. Germany has an abundant store of ores fit for reduction by the basic steel process—the invention of British metallurgists—"and it would indeed be extraordinary if a capable and industrious nation such as the Germans are, with all their faults, could not succeed in making most of the steel required for their own uses." Then, again, he said, while their chemists can point to the German predominance in dyes, England can point to whole districts of Germany that depend for the prosperity of their textile mills on yarn spun in Lancashire, and upon machinery made there. At the present moment, these industries are brought to an absolute standstill by the lack of English yarn. Indeed, he added, quite a number of German industries absolutely depend on England for their success.

Taking the coal production. In 1911 the coal-mining industry of the United Kingdom raised close upon 272 million tons; the figure for Germany being 158 million tons. These figures will derive greater significance by division into the actual consumption of coal per head of the population in each country, which may be regarded as a measure of the intensity of industrial effort. In the same year, the United Kingdom consumed 4·01 tons per head, and Germany 2·03 tons; the United States capping both with 4·54 tons. "These figures," urged the Chairman, "show clearly that America and England have reached a higher stage of industrial civilization than Germany. The larger coal consumption shows that America and England require greater motive power and greater use of fuel for metallurgical and other processes than Germany."

Again, going back to 1911—the latest figures available—the total external trade of the United Kingdom was £1,031,000,000; that of Germany, £807,000,000. In the matter of imports, England is the great creditor of the world. Then looking at the matter another way, in Germany the average income per head of the population is but little more than half of what it is in England; so that tested by this Germany is, compared with us, a poor country. All tests which can be applied, in fact, show the English as a nation, he urged, to have attained greatly superior results as compared with Germany.

The Chairman, pursuing his subject, said that England was also successful in science and invention. An examination of the leading scientific work of this country shows that it is always brilliant, far-reaching, and early in the field; and practically all fundamental discoveries in this direction have originated in England, France, or Italy. Germany's scientific work, he admitted, is undoubtedly of an important kind; but "it is always of what may be called the 'pedestrian' type—hard working and plodding, but with little foresight or brilliancy." In proof of the first part of this claim, many well-known scientists were cited, together with the work done by them, all going to show that, in pure science, "whatever opinion may be held as to our methods, our results greatly surpass those of Germany." Much the same thing, Mr. Dugald Clerk maintained—and he brought forward ample facts to support his argument—applied to the invention of England, which was more important than that of Germany. Germany is successful with us "because she shares the results with ourselves of the work of the whole world; but she shows no signs of success in the least likely to overcloud England. Our professors are entirely mistaken. They see a successful Germany; and they imagine her more successful than she is. They see an unsuccessful England, simply because they have failed to take a broad view of the whole position."

The same train of thought applied to circumstances connected with the war brought to the close an address which was both well-reasoned and inspiriting.

INSPECTION OF FACTORIES.

There is necessarily very much that is of a special character in the report of the Chief Inspector of Factories and Workshops for the year 1914, which made its appearance at the end of last week. As pointed out by Sir Arthur Whitelegge, the whole work of the Department has, in consequence of the war, undergone a great change. The effects of this change will, of course, be still more noticeable when the report for this year is published, although naturally the disturbance was most felt in the early days of the war, towards the end of 1914. Apart from difficulties which have been experienced through inspectors and other members of the staff joining the forces, several industries were at the outset brought almost to a standstill.

A serious state of unemployment was at first apprehended; but very soon the demand for supplies of all kinds resulted in numberless applications for special latitude with regard to hours, &c. As the result of careful inquiry, various schemes of work were drawn up, so as to meet as far as possible the need for greater output and at the same time to protect the workers. On the latter point, an effort has been made to examine the effect which the long spell of overtime has had on the health of the workers; and though it may perhaps be too soon to arrive at definite conclusions, there is stated to be a noticeable absence in all reports from the inspectors of any evidence of increased sickness. It has, however, in many cases been found necessary to reduce overtime because of the strain imposed upon the workers by long spells of extra hours. Looking at the question as a whole, it is thought that it is probably safe to say that, whatever may be the future effects of so prolonged a strain, there is at present no sign that workers have been injuriously affected. As to the effect on production, instances have repeatedly come to light where it has been found that output has gradually fallen away when long spells of overtime have been worked, and this has led to a noticeable general tendency to reduce the overtime. The whole experience of the last few months, says Mr. G. Bellhouse (Superintendent Inspector of Factories), in a special report on the subject, leads unquestionably to the conclusion that, while long and even excessive hours can be worked with advantage for short periods, continued overtime, if not kept within proper limits, soon fails in its object and ceases to aid production, though the limits may vary in different industries, according as the work is arduous or light.

On looking into the present report, it is noticed that it has been prepared on a different plan from those issued in previous years; the contents being arranged in chapters which are intended to record the year's work in a form more convenient for reference. The first chapter deals with the subject of sanitation, and contains some remarks upon lighting. It is stated that the importance of adequate lighting, both natural and artificial, is being appreciated more every year; and though the inspectors have no statutory power to require lighting generally, the suggestions they have made at their visits have resulted in the remedying of conditions which must have caused injury, not only to eyesight, but to general health. Though the more modern works have usually enough lighting power, the arrangement of the lights is often bad. One of the inspectors refers to the injurious use of metallic filament electric lamps close to the eyes of workers. Such lamps are often in clear bulbs with very small shades; and he has recommended large, opaque shades. He adds: "Very little attention appears to be given to providing good, or rather well-arranged, artificial lighting. I think it is largely left to any contractor who puts up the lights; and in regard to electric lighting, the number of points affects the cost, and tends to handicap proper distribution." Other inspectors point out the progress recently made in artificial lighting by the substitution of electricity or high-pressure gas for ordinary gas lighting.

Under the heading of temperature, it is stated that many gas supply authorities now refuse to fit flueless stoves in places under the Acts, and nearly all makers of stoves now provide flues. The inspector for the Bristol area reports that one firm in his district has recently so altered the design of the stove used as to provide a system of flues which convey the burnt gases in a horizontal direction through the room and thence to the open air—by which means, "the heat of these gases, which forms a considerable part of the thermal efficiency of heating by ordinary gas-stoves, is largely utilized without the gases being poured into, and contaminating, the air of the rooms." In some instances, reference is made to the increasing use of electric radiators: "but," it is added, "the cost of this form of heating is still very high."

Allusion is made by several of the inspectors to the formation in factories of small safety committees composed of workmen, to investigate accidents, and prevent their recurrence—on the lines of the jury system adopted by the South Metropolitan Gas Company. At one large works where the plan of having a safety committee has been followed for the past seven years, says the report, comparatively few accidents now occur, owing to the increased attention given to fencing; and not many of these become serious, as very great care is paid to first treatment of the slightest injuries. In this case, the safety committees systematically inspect the machinery and plant in their respective departments, and report as to proper maintenance of the safeguards. An investigation is made into the cause of every accident, and to apportion any blame—the findings being duly posted in the works. The plan adopted at another factory is for all machines and safeguards to be inspected three times a day by skilled workmen, who report immediately to the manager any defects or repairs needing attention. This plan has resulted in a marked diminution in the number of accidents.

Explosions in connection with gas-works purifiers are reported from Liverpool and Staffordshire, with injuries to several workmen in all the three cases recorded. The cause of the explosions, the report states, appeared to be ignition of accumulations of gas, in imperfectly ventilated purifier boxes, by sparks from the workmen's shovels when removing layers of oxide of iron from the boxes. A Diesel engine was partially wrecked by an explosion, but fortunately without personal injuries. Cylinders containing compressed air were being used to start the engine; and one of these was found to have held oxygen, though sent out with others containing air only, and similarly marked.

The chapter devoted to women and girls in industry, by Miss Anderson (Principal Lady Inspector of Factories), is a long and important one. Miss Anderson remarks that it is impossible to give, as one would wish, any exact estimate of the increase, which must be very great already, and is bound to grow greater, of the number of women and girls employed in factory industry. She does not see how it can be much less already than 100,000; and it may be more. If the normal rate of increase during the fifteen years preceding the last return from employers to the Factory Department, in 1907, was maintained, not less than 2,000,000 female workers were at the outset of war already employed in industries under the Factory Acts.

The number of electrical accidents at generating stations and sub-stations was 99, as against 94 the previous year, with four fatalities compared with three. The mechanical accidents were 13 per cent. less; and were such as are liable to occur in engineering works. One, which caused two deaths, was due to the bursting of a steel bottle of compressed air for starting a gas-engine. Electrical accidents in factories (350) were 16 per cent. less than in the previous year; the number of fatalities (16) being one less. During visits of inspection, numerous examples were found of dangerous switch-gear and other apparatus contravening the regulations. In high-pressure stations, switchboards without any protection of conductors within easy reach of persons in the passage-ways were noted.

Details are given in the report of a case of arseniuretted hydrogen poisoning which appeared to have been contracted during the cleaning of one of the saturators used for the manufacture of sulphate of ammonia in a shale oil works. It is usually found necessary to clean these lead lined saturators about once in every six weeks. The saturator concerned in this case was put out of action early one morning; the ammonia gas pipe and exhaust being shut off, the door of the saturator opened, and any liquor remaining blown out by the ejector ordinarily employed for blowing out the sulphate. Deceased, who was foreman in the sulphate house, then poured some water into the saturator, to dissolve any solid deposits. On the following day, he entered the saturator with a galvanized pail, and removed the water. He was also in the saturator on the two following days, for some time; and on the latter occasion he complained of feeling unwell. Death took place four days later. Exactly how this dangerous gas was generated in this and previous similar cases, says Dr. T. M. Legge (the Medical Inspector of Factories), is still shrouded in mystery. At the principal works, the view is held that the galvanized pail was the deciding factor; but the local managers of the crude oil works hold an opposite view—the manager stating that deceased was in the habit of remaining in too long at a time. Subsequently, all occupiers of shale oil works were requested—apart from general measures during cleaning operations, to ensure a constant supply of fresh air and limitation of the time a man should remain in the saturator—to substitute wooden for metal pails in the sulphate house and in tanks which had contained either sulphuric or hydrochloric acid, as the surest means of preventing the occurrence of this fatal form of poisoning.

There were 21 cases (none fatal) of poisoning by power gas, and seven with coal gas—one fatal, which occurred from unscrewing a ball-cock after gas had passed through a purifier. There were also eight cases (two fatal) of sulphuretted hydrogen poisoning in attending to gas-works purifiers; six (one fatal) in cleaning out pipes or stills in tar-distilling works; five in chemical works (including one at a sulphate of ammonia works); and one in cleaning out the pump-hole in a gas-works.

CRITICAL REVIEW OF THE METHOD EMPLOYED FOR DETERMINING HEATS OF COMBUSTION.

By Stanley Robson, M.Sc. (1851 Exhibition Scholar of the Armstrong College, Newcastle-on-Tyne),
Research Student in the Department of Chemical Technology, the Imperial College of Science and
Technology, London.

Introduction.

he accurate determination of heats of combustion is a matter great importance, both scientific and technical, and has been e subject of much research on the part of distinguished investiators during the past seventy years. But, owing to the unusually eat experimental difficulties involved in such work, it is perhaps rdly surprising to find sometimes substantial differences between e results obtained for one and the same substance by two or ore investigators of equal eminence and experience; and there still, in such cases, room for further research.

At Professor Bone's suggestion, the author undertook, more an a year ago, a careful perusal of the literature of the subject; d the object of the present review is to indicate how far existing ta may be regarded as reliable from the standpoint of presenty demands. The literature of the subject is spread through so any journals, both British and foreign, and there has been so tle published in the way of unprejudiced critical comparison tween the results obtained by various workers, that it is perps not surprising to find that in many text-books the less curate values obtained by some of the earlier investigators—*e.g.*, ose of Favre and Silbermann, published in 1852—are commonly ven in preference to the later values obtained by Julius Thomn, Berthelot, and Stohmann. Moreover, in regard to the later ork, the controversies between the followers of Berthelot and homsen, as to the relative merits of the methods employed, came at times so partisan that it was difficult to arrive at an biassed judgment upon the issues involved.

The author has confined his attention in this review principally the work of Andrews, Favre and Silberman, Thomsen, Berthet, and Stohmann, as being the most important. The subjectatter is treated, as far as possible, chronologically; but, for the ke of convenience, the work of each individual investigator is nsidered by itself. In each case a short critical description of e method employed is given—not, indeed, in the hope of dealing haustively with all possible errors, but rather to draw attention oadly to the limitations and the discrepancies in the final sults. And it is hoped that it may perhaps lead to a careful resion of some of the more doubtful values, now that the means ailable for the preparation of substances in a high degree of emical purity are so much in advance of those employed thirty ars ago, and that refined calorimetric instruments and methods e more widely at the disposal of the general body of scientific orkers.

I.—Earlier Determinations of Heats of Combustion.[*]

The earliest experiments of any note were made by Lavoisier bout 1789), who used his well-known ice calorimeter (Fig. I.). his instrument, although capable of yielding fairly accurate relts in certain cases, when all due precautions are taken, was on abandoned for more convenient forms. The investigations Dalton and of Davy (about the year 1800), on the heat proced in certain cases of gaseous reactions, may be mentioned in ssing; but the methods employed were, from a modern standint, too inaccurate to warrant any detailed consideration. The sults, however, obtained by Despretz (about 1840), and also by ılong (1830-40), were probably much more valuable. Unfornately, there exists no detailed account of the methods of the rmer worker; and the only knowledge we have of Dulong's ethod is from a brief account given by M. Cabart,[†] one of his collaborators. It appears that his apparatus was, in principle, the precursor of the form commonly used by later workers, where the substance was burnt under conditions of constant pressure. Several important details, however, are not clear; and it is to be regretted that the methods used by both these eminent investigators are not fully recorded.

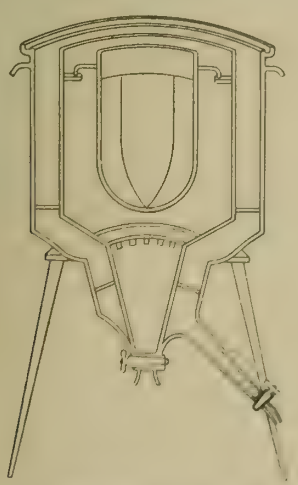


Fig. I.—Lavoisier's Ice Calorimeter

The following are Dulong's values for the heats of combustion of some substances:—

Hydrogen	= 34,743	calories per gram.
Carbon monoxide	= 2,634	,, ,,
Methane	= 13,185	,, ,,
Ethylene	= 12,030	,, ,,
Ethyl alcohol	= 6,909	,, ,,
Sulphur	= 2,601	,, ,,

Despretz's value for the heat of combustion of one gram. of carbon is 7900 calories.

II.—Work of Thomas Andrews (1840-8).

The first really important work of which we have a complete account is that of Thomas Andrews.[*] The general features of his experiments undoubtedly anticipated those of Berthelot; and in the clearness of his conception of the meaning of his results Andrews was superior to any of his contemporaries.

Andrews' method was to lead a mixture of the combustible gas under investigation and air [usually in the combining proportions] into a cylindrical copper vessel, closed by a screw, and having a lid perforated by a conical aperture (the apex of which was towards the outside) to admit a very tightly fitting cork. Through this cork a silver wire A A (Fig. II.) was passed; and another, B, was soldered to the side of the screw. The wires were connected by a fine platinum wire, which could be fused on completion of the circuit, through a voltaic battery. The calorimeter and jacket were so designed as to be capable of rapid rotation, by which means complete uniformity of temperature was obtained. The temperature of the water of the calorimeter was then read, and the platinum fused by connecting the exterior of the apparatus to one pole of the battery, while the wire lead from the other pole was passed through the water, until it came into contact with the insulated silver wire, or an insulated copper band C C (Fig. II.a). The orifices A B (Fig. II.) were immediately stoppered; the lid of the outer vessel shut down; and the whole rotated for thirty-five seconds, in which short space of time the heat produced by the combustion was found to be uniformly distributed throughout the apparatus. As soon as this was judged to be complete, the thermometer was again introduced, and the increment in the temperature observed.

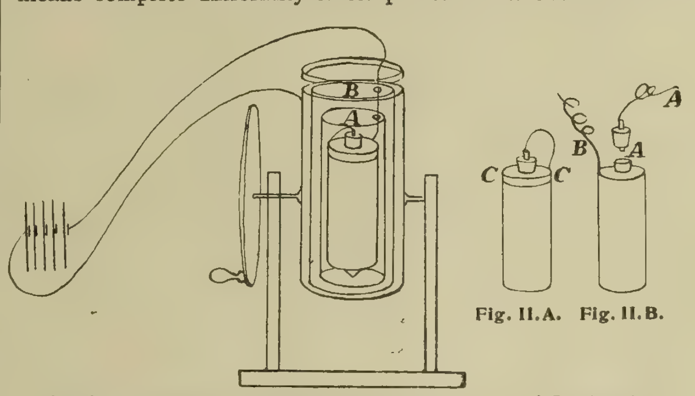


Fig. II.A. Fig. II.B.

Fig. II.—Apparatus of Thomas Andrews for Heats of Combustion of Gases.

The temperature of the surrounding air was, in general, a little above the mean between the initial and final temperatures of the apparatus. The heat, however, was given out so rapidly that the latter must have been nearly at the final temperature during the greater part of the time.

After each experiment, the apparatus was again rotated for thirty-five seconds, and the loss of heat observed. One-half of this loss was taken as the required correction for air contact and radiation losses, except in the case of olefiant gas, when the initial temperature was a little lower than usual. The total correction thus applied never exceeded 0·005°C. The water equivalent of the apparatus appears to have been calculated from Regnault's figures for the specific heats of the substances employed. As the gases were collected over water, they became contaminated with a small quantity of air, which was in each case directly estimated and a suitable correction applied.

The above method, though capable of improvement in detail, is in principle very good; and, considering the early period of the experiments, it was probably superior to any other employed up to that time. The employment of an explosive mixture of the

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Elements of Chemistry. Lavoisier, 1789.

Comp. Rend., 1843; also Ann. Chim. et Phys., May, 1843.

[*] Memoir to the Academy of Sciences of Paris, March, 1845; also Phil. Mag., S.3, Vol. 32, No. 216, May, 1848.

constituent gases, and in approximately theoretical proportions, was novel, and enabled an electric ignition to be employed, which was undoubtedly superior to the means used in the contemporary work of Favre and Silbermann.

The correction for loss of heat by radiation, &c., was always very small, since the maximum temperature was never more than 1° C. above that of the surrounding air, and since the temperature became uniform so rapidly. Andrews was, therefore, justified in only making the simple corrections he described.

The combustion took place under "constant volume" conditions, though the walls of the combustion chamber were perhaps too thin to exclude the possibility of some bulging during the process; and if this occurred a small indeterminable error would be introduced. Andrews' results are, therefore, approximately "constant volume" values. For the purpose of comparison with later results, the author has applied a suitable correction, transferring them into "constant pressure" values.

Among the more obvious sources of error involved in the method, the following may be noted.

(1) The method of temperature measurement did not admit a high degree of accuracy. There is, in the first place, no information as to the calibration of the thermometer used. It is, however, doubtful whether it could be read to a greater degree of accuracy than 1-100th of a degree under the most favourable circumstances; and it certainly would be impossible to reach this accuracy under the rapid insertions and removals detailed in the account of the course of an experiment. The maximum increase in temperature appears to have been about 2° C. The error in thermometer reading could, therefore, hardly have been less than 1 per cent. or even more. Thermometer reading is, however, probably the source of the greatest error.

(2) The use of an unprotected copper vessel for the combustion chamber was a source of error of unknown magnitude, though it may probably be considered small, as the metal surface would become coated with a film of oxide in the earlier experiments of the investigation.

(3) With regard to the results obtained for the heats of combustion of hydrogen, carbon monoxide, marsh gas, and ethylene, which are tabulated below, it is doubtful whether, except possibly in the case of carbon monoxide, the purity of the gases actually employed can be considered as satisfactory. The method used for preparing hydrogen was unfortunately not described in his paper; but, if, as is probable, it was prepared from zinc and dilute sulphuric acid, it would contain quite appreciable quantities of methane, which would not be eliminated by the purification process to which the crude gas was subjected. The methane used was a sample of natural "marsh gas." It was analyzed, and a correction applied for the ascertained nitrogen content. The possibility of small quantities of other impurities was not allowed for. Again it is stated in Andrews' paper that the ethylene was prepared "by the usual process" [? alcohol and sulphuric acid] and contained 6·4 per cent. of carbon monoxide, for which a correction was applied in calculating the results. It is certain, however, that other impurities would be present.

Andrews' mean results for the heats of combustion of hydrogen, carbon monoxide, and methane agree within about ½ per cent. with those obtained years later by Julius Thomsen. This agreement is remarkably close, considering the undoubted impurities present in Andrews' gases; and it would seem as though the experimental errors in the method had balanced fairly well.

Andrews' Results for the Heats of Combustion of Gases.

Gas.	Preparation or Source.	Purification.	Individual Experiments.	Mean Value
			Calories per Litre.	
Hydrogen H_2	Not given	Passed through solutions of: (1) Lead acetate (2) Silver sulphate (3) Caustic potash	3025 3043 3052 3025	3036
Carbon monoxide CO	From sulphuric acid and oxalic acid	Passed through caustic potash solution	3063 3053 3060 3051	3057
Methane CH_4	Natural marsh gas analyzed and found to contain much nitrogen	—	9413 9431 9420	9420
Ethylene C_2H_4	Prepared and purified by the usual processes contained 6·4 per cent. CO		15,056 14,979 15,012	15,016

(*To be continued.*)

Domestic Heating Apparatus.—The Sanitary Committee of the Manchester City Council have adopted a resolution to the effect that application be made to the Committee of the Privy Council for Scientific and Industrial Research for a grant of £400 for the purposes of research into the efficiency of present-day domestic heating appliances.

TECHNICS OF FIXING GAS-FIRES.

By Thomas Newton, of Hereford.

The healthy rivalry among gas-fire manufacturers is the best guarantee that consumers' interests are in no danger of being ignored, especially when we consider that the general trend of inventions relating to gas-fire construction lies in the direction of securing the maximum ultimate result measured in terms of efficiency and comfort with the minimum consumption of gas.

As regards the gas profession, it does not seem to have yet realized its indebtedness to those inventors and manufacturers who have encountered and overcome innumerable obstacles in the design and construction of gas-fires, thereby putting in the hands of most gas undertakings a ready means of acquiring a substantially increased and assured output. One has but to take a retrospective glance at the marvellous strides which have been made in this direction during the past decade, in order to appreciate the nature of the difficulties that have already been surmounted. An up-hill fight against the fads, the fancies, and the prejudices of the general public has been fought and practically won. It now remains for the position thus obtained to be consolidated; so that the fullest possible advantage may be gained. Never was any time so opportune as the present for a well-considered and persistent campaign of publicity, having for its object the enlightenment of the general public as regards the hygienic, the economical, and the labour-saving characteristics of gas-fires.

Every Fire an Advertisement.

Having conceded so much, then, to modern gas-fires and their makers, one may well inquire if the former are being made the most of in the hands of those who are responsible for their fixing and their general efficiency as an ultimate result. Just as a well-designed machine or plant suffers in efficiency if it be improperly or badly fixed, so also will the best of all possible fires suffer, and yield unsatisfactory results, unless intelligently and competently fixed. Every fire that is fixed may be regarded as either a good or a bad advertisement of (*a*) the fire itself, (*b*) the fitter who fixed it, and (*c*) the undertaking responsible for the fixing. Viewed from this standpoint, the consequences of a good or a bad job are obvious.

A good and suitable fire, fixed in a competent manner, gives a high efficiency, and general satisfaction; and it becomes at once a good advertisement which yields practical results. Conversely, an unsuitable, or even a good, fire improperly (or incompetently) fixed, yields a comparatively low efficiency. It also stereotypes prejudice; and, in addition to being a bad advertisement, it may in time come to be regarded as an unmitigated nuisance. Therefore the proper selection, and the competent fixing, of gas-fires are matters of supreme importance to the industry as a whole.

The practice of simply standing a fire on a tiled hearth, or elsewhere, and connecting a gas supply to it, cannot be too highly condemned. With a comparatively small base, and the centre of gravity fairly high, a gas-fire is inclined to be top heavy. [Of course, there are a few types which are exceptions to this rule, as, for example, a dog fire; but generally the former type is typical of the vast majority.] Hence, unless it is securely fixed in position—independent altogether of the gas supply—it is apt to rock about, and throw an undue strain upon the supply pipe. Moreover, a careless servant during the process of dusting, &c., could readily disarrange it, and alter its position, which might result in the products of combustion entering the room the next time it was used—with disagreeable consequences. A fire "fixed" in this manner is a standing invitation to the user to rescue it from its perilous position. And it also betokens a strange lack of confidence in the permanent utility of gas-fires on the part of those responsible.

The Gas-Fire as a Permanent Fixture.

The idea of permanence should be diligently preached to those who have anything to do with the fixing of gas-fires. One never comes across a coal-grate temporarily fixed; and considering that a gas-fire may be permanently fixed with but a small amount of labour added to that required for a temporary job, it is essentially a practical proposition so to fix it. When a gas-fire is fixed in front of a grate, oftentimes all that is required is a couple of holes in the fire, and two corresponding holes in the grate, which latter should be tapped to receive two $\frac{3}{16}$-inch mushroom-headed screws. Sometimes one will suffice. By this method, the gas-fire can be securely attached to the grate, and thus rendered as permanently fixed as the grate itself.

There are many distinct advantages in thus permanently fixing gas-fires. A most important one is that the owner or hirer, not being able to remove a gas-fire readily, comes to regard it as a fixture in the best sense of the term, and uses it accordingly. Further, in the event of the burner requiring cleaning out (which, by the way, does not happen as frequently as some chimneys require sweeping), the owner or hirer, as the case may be, is not able to discard it hastily and revert to coal without first notifying the gas department. This is a great gain, inasmuch as the complaint can at once be attended to, and a prospective loss averted. It is no exaggeration to state that the defects which are inherent in the temporary fixing of gas-fires are a direct incentive to users to discard them in favour of coal-fires. And if gaseous fuel is ever to supersede solid fuel—which we all thoroughly believe—then the sooner the fixing of gas-fires is put on a permanent basis, the better will it be for all concerned.

EXPERT ADVICE TO CONSUMERS.

In the choice of gas-fires, consumers need guidance and expert attention. The size of the room to be heated; the character and type of the coal-grate in front of which it is to be fixed; the planning of an adequate supply; the nature of the chimney draught—are all important factors which require due consideration if a satisfied consumer and an efficient permanent gas-fire are our chief concern. It would be manifestly absurd, for example, to allow a 10-inch fire to be selected for fixing in a room (say) 15 feet square. Similarly, it would also be absurd to select a fire having a semi-circular top for fixing on a tiled hearth in front of a registered grate whose "squareness" is the main outstanding feature; or a square-topped fire for fixing in front of an old-fashioned "mantel-sham" grate having a bold semi-circular raised moulding or ornamentation on its front. A fire having a semi-circular top should be selected for the latter type of grate; and, if necessary, a sheet-iron stand, or a wooden one encased in sheet iron, but with an asbestos slab under the iron at the top, should be made to the approximate shape of the base of the fire, so as to raise it sufficiently to make the arched top of the fire coincide with the arched moulding of the grate.

COMBATING DOWN-DRAUGHTS.

Wherever practicable, the bars of the grate should be removed so that the gas-fire may fit snugly within the contour of the moulding, in which case no sheet-iron back is required, provided the draught of the chimney is normal. If, however, the draught is sluggish, or where there is a tendency to down-draught, a plate of iron cut to fit over the grate opening, and securely attached to the grate, will invariably prove effective. Of course, in this case, the plate will have to be cut to accommodate the nozzle of the fire. Obstinate cases of down-draught have to be dealt with on their merits. What will cure one will not cure another; but there is probably no case of down-draught that will not yield to a little careful thought and application.

If due regard be paid to the proper selection and fixing of gas-fires, little or no flue-pipe is required in the majority of cases. But where a flue-pipe is used, it should be securely fixed to the nozzle of the fire by means of a small screw and nut. This effectively prevents the flue-pipe falling off, or falling to the side of the chimney, in which position it is apt to obstruct the passage of the products of combustion. Where an elbow is used the upper portion should terminate in a cone, or an inverted V to prevent soot and mortar entering the flue-pipe; but the conical part should, of course, be raised sufficiently above the end of the pipe to permit of the free passage of the fumes to the chimney.

ROOM VENTILATION.

The problem of getting rid of the products of combustion is closely allied to the intricate problem of effectively ventilating the room; and neither problem can be usefully considered without reference to the other. Objection has been taken to the practice of fixing a sheet-iron plate over the grate opening at the back of a gas-fire; but coal-grates and chimneys have to be taken as one finds them, and scores of cases could be cited where the fixing of such a plate is an absolute necessity in order to get rid of the products of combustion. Incidentally, in many cases, the ventilation of the rooms has been very considerably improved as a direct consequence; and this is probably the strongest argument that can be advanced in favour of placing the ventilating arrangement of a ventilator-fire in the immediate vicinity of the flue outlet.

A square-topped fire is preferable for fixing in front of a register grate having a fixed or immovable canopy; and in this case, too, a little sheet-iron work is necessary in order to obtain a vertical plane against which the back of the fire should tightly fit, where it should afterwards be screwed in position. The sheet iron should extend the whole depth of the grate—from the hearth to underneath the lintel of the chimney piece; and the sides should be bent so that the whole will somewhat resemble a trough (with open ends) of semi-rectangular section—the idea being to cover the canopy and bars without covering the tiled panels, and yet at the same time obtain a flat front equal in width to that of the back of the fire.

Both the iron work and the fire should be screwed to the grate with four $\frac{3}{16}$ inch screws. If properly executed, this makes a first-class job, and looks quite presentable—besides having the added virtue of being thoroughly substantial. In the event of a ventilator fire having side ventilating arrangements being selected to occupy a similar position, the advantages of this sheet iron are at once obvious; but in this case communication between the ventilator and the chimney must be established by cutting away the sheet iron where necessary. A side ventilating arrangement is obviously useless unless the back of the fire fits perfectly against a surface lying in the same plane as that of the back of the fire. Unfortunately, a register grate presents many surfaces, few of which lie in any given plane.

THE "INSET" FIRE.

A type of fire deserving of greater popularity is that known as the "inset." This, as its name implies, is intended for setting in the grate itself. This fire should only be fixed in a register grate having a movable canopy, or, alternatively, one having a fixed canopy which projects well over the front of the bars. Properly fixed, this fire presents a neat and attractive appearance, and immediately reconciles those to the use of gas-fires who have a decided objection to one standing on the hearth.

Before a fire of this description is fixed, the chimney should be swept. A plate of sheet-iron is then cut to fit the chimney at a point just above the top of the canopy. In the centre of this plate, an oblong hole, equal in area to the nozzle of a 14-inch fire, is cut; and an oblong flue-pipe, about 8 inches long, having a ridge top mounted just above the end, is securely fixed to the plate directly over the hole. The combined plate and pipe is then fixed in the chimney just above the top of the canopy, where it will prove an effective trap for falling dust and dirt. The fire should now be fixed in position, with two small screws [the bars of the grate having previously been removed]; and the cavity between the back of the fire and that of the grate is filled with fire-clay—the top of which should slope upwards—and should also be smoothed with a trowel to impart a finished appearance. Some makers supply a fire-brick with this type of fire; and this is a step in the right direction. But even so, it is more effective when resting on a fire-clay foundation, and when the interstices between the brick and grate back are fitted with fire-clay also.

This method of fixing a gas-fire of this description never fails to give satisfaction; and it effectually disposes of the objections sometimes urged against it—viz., that all the heat goes up the chimney, and all the dirt comes down.

THE TILED RECESS.

In the foregoing, the author has considered the fixing of gas-fires as a hiring proposition, and from the standpoint of a tenant's fixture, under which circumstances the removal of a coal-grate is more or less impracticable. Where, however, the coal-grate is to be entirely discarded by the owner, a tiled recess, or alternatively a tiled slab, furnishes an ideal setting for a gas-fire. These tiled surrounds are eminently suitable for the installation of the more artistic types of gas-fires known as dog-grates, which, however well they may be fixed, do not at all harmonize with their surroundings when fixed in front of coal-grates.

ADEQUATE GAS SUPPLY ESSENTIAL.

As regards the gas supply to a gas-fire, if is almost superfluous to add that even the best fire will prove but a sorry failure unless the supply of gas is adequate. Therefore nothing less than ½-inch piping should be used to supply a fire up to 14 inches in width; and this should be laid independently from the meter. Where the distance from the fire to the meter exceeds (say) 40 feet, or in the case of a fire larger than 14 inches, a pipe of more ample dimensions is preferable. Nothing is so ridiculous as to attempt to supply a fire by connecting it to a small pipe which already supplies a pendant or a bracket as the case may be.

The installation of a number of fires in a given building necessitates an independent system of piping of ample dimensions to supply them adequately. Generally, the internal piping arrangements of most residences err on the small side; and in the event of a fire being connected to the lighting supplies, nothing is more exasperating to the user than to find that the fire can only be used at the expense of the light, or the light at the expense of the fire.

FLOOR FITTINGS.

A floor-cock should be fixed in connection with every fire, and this should be screwed to the floor, in a convenient position, close to the fire. Between the floor-cock and the fire, brass, copper, or aluminium tubing, of ½-inch diameter, should be used. On no account should compo. piping be used on a hearth; nor should aluminium tubing be permitted under a hearth. Where polished brass predominates on a hearth, a polished brass floor-cock and polished brass tubing are preferable. In the case of a copper fire suite, a brass floor-cock with an oxidized copper finish and copper tubing would be more in keeping with the general arrangement; while for an armour-bright fire suite, a brass floor-cock having an oxidized silver finish and aluminium tubing would better serve the purpose. These small refinements, although apparently insignificant, are in reality essentially important details in the eyes of those with whom progressive gas men seek to do business, and should be studied accordingly.

A Rapidly Completed Gas Plant.—An American publication, issued at Buffalo ("Gas Record") states that the Plymouth and Northville Gas Company, of Plymouth, Mich., began constructional work on their new coal-gas station on April 15 this year, and on Sept. 8 were supplying gas to the consumers—having erected the buildings, holder, and equipment and laid seven miles of mains. The plant has a capacity of 150,000 cubic feet of gas per day. Since Sept. 8, the Company have laid four miles of mains to Northville, and expect to finish the laying of about five miles of mains in Northville in another thirty days. A Buckeye traction ditcher was used for trench work. The Company have a low-pressure system in Plymouth, and a high-pressure line to Northville, and are using 3, 4, and 6 inch wrought-steel pipes in both towns. Already 250 services and about 150 meters had been installed in Plymouth—including three large air-rifle factories and one auto-factory, which will be large consumers. The Company report a splendid sale of stoves and appliances; and the prospects for business next year are first class.

PROGRESS IN ILLUMINATION.

American Illuminating Society's Report for 1914-15.

The October issue of the "Transactions" of the American Illuminating Engineering Society contains the report of the Committee on Progress, as presented at the ninth annual convention held at Washington in September.

It points out that illuminating engineering is becoming recognized as a profession, as attested by the employment of an illuminating engineer to take care of the lighting of the Panama-Pacific Exposition at San Francisco, and by the announcement by the United States Government of examinations for the position of illuminating engineer in the office of the supervising architect at Washington. Then, again, the enormous demand for all sorts of material required by the nations at war has necessitated night work in a large number of foreign factories, which has stimulated interest abroad in satisfactory and efficient systems of interior illumination.

The list of subjects covered by this year's report is slightly different from that shown in the report of last year. Some subjects are missing, and others have been added, which (as the Committee remark) is natural, since progress is continually appearing in new directions.

The report then deals with progress made—dividing the matter up into fifteen different sections, extending to 45 pages of print. Some of these (so far as they deal with gas and gas lighting) are reproduced to-day.

GAS-BURNERS.

A very important development in incandescent gas lighting is the recent introduction of an upright unit fitted with three miniature mantles in soft form and made from artificial cellulose fibre. This type of lamp operates well over a reasonably fair range of gas pressure and qualities, is efficient, and requires no enclosing draught-inducing cylinders. It can replace open-flame burners without glassware change on present fixtures, and furnishes a means of obtaining semi-indirect or indirect illumination.

Several new types of inverted burners provided with inclined shoot-like heat-baffles, to divert the products of combustion entirely away from the fixtures, have been worked-out in sizes giving approximately 100, 150, and 250 horizontal candle power. These units are finished with a non-tarnishable, heat-resisting lacquer, and are so constructed that the heat-discharge vents are completely hidden. Being entirely of metal, they can be finished to match the fixture on which they are to be used. The gas-lamp designed to take advantage of the fact that the hottest part of the flame from a Mèker or inverted bunsen burner is in the neighbourhood of the small green inner cones, and, as mentioned in last year's report, has been in use in Germany and proved the prediction of unusual sturdiness and long life.

An elaborate study of the room ventilating action of various types of gas-burners has been made in England ["JOURNAL," June 8, 1915, p. 573]. The results show that the ventilating efficiency is greatest for upright burners; that of the inverted burners, those giving a clear passage for the gases had the greatest ventilating efficiency; that the addition of deflectors intended to protect the fittings from the action of the gases reduced the ventilating efficiency by as much as 9 per cent. Experiments made in America, however, show that when the stack is properly designed, higher efficiencies are obtained with deflectors, due to a superheating of the mixture before burning. Globes with a very open base had no effect on the ventilating efficiency, but those with a constricted opening produced a reduction dependent on the area of the opening.

To produce the best results with the use of gas for lighting purposes, the character of the bunsen flame used in conjunction with gas-mantles must not change materially. In order to enable a manufacturer to ascertain how closely his service is maintaining constancy of burner conditions, a gauge has been developed, consisting of a small, slender upright bunsen tube (of exact design and carefully drilled orifice) mounted on the same base with a pressure gauge. A scale is placed at the side of the bunsen tube in order to check the length of the inner cone. Any variation of the cone-length above or below a specified point can be easily noted. The gauge is not calibrated to indicate any specific quality of gas, but will show only those changes which will affect bunsen burner service.

Despite the long life and high efficiency of the present-day gas-mantle, efforts are still being made by inventors ["JOURNAL," Feb. 23, 1915, p. 442] to either strengthen the structure or intensify the illuminating power by the application of some solution after the mantle has been purchased. Such efforts have not in the past been very successful.

Whether illuminating gas causes the fading of colours in fabrics has been made the subject of careful testing—experiments having been continued for a period of ninety days ["JOURNAL," Dec. 22, 1914, p. 680]. It was found that the deterioration of colour, either due to temperature, illumination, or the products of combustion arising from the use of gas lighting, is of no practical importance compared with the effect of daylight.

AUTOMATIC LIGHTERS.

The protected pilot tip so successfully applied to outdoor gas arc-lamps has now been modified for use on indoor burners, reducing the pilot flame outages to a minimum. A very simple electric gas cock for the distance-control of gas-burners has been produced. In Florence (Italy) a system of distance-control for gas lighting ["JOURNAL," March 2, 1915, p. 504] has been in satisfactory use for the past three years. As a result of a recent successful test by military authorities, in which the city gas was shut off at a specified time and relighted after a predetermined period, it is expected that this system will shortly be employed in Italian frontier and coast towns. In general, inventors are looking toward means for making distance lighting by pressure waves selective ["JOURNAL," May 18, 1915, p. 409].

HEATING VALUE.

The use of the calorific standard for gas in place of the candle-power standard is increasing in America. In many localities both standards are still required; but it seems to be a quite general experience that if the gas is maintained at the right calorific value, the candle-power value will be satisfactory. At the 1914 convention of the American Gas Institute there was referred to the Board of Directors the question of adopting the "Metropolitan" No. 2 (Carpenter) argand burner as the standard burner in the determination of gas candle power. It has been suggested by the Bureau of Standards that "for those places where a candle-power specification is necessary, in order to afford protection to users of open-flame lights, . . . an open-flame burner should be used in testing the gas candle power." As the number of open-flame burners used in the States is relatively small, the advisability of adopting this suggestion has been seriously questioned. The Bureau also suggests that the adoption of any standard burner might delay the present tendency toward the adoption of heating value standards.

Data have been given of experiments which indicate that calorific value, specific gravity, and gas candle power do not definitely specify a gas for commercial purposes. Gases which are identical in these properties may yet differ so in composition that the resultant flame temperatures will vary greatly; hence the performance of incandescent lighting appliances cannot be predetermined on this basis. It has been found, however, that heating values above 600 B.Th.U. are not desirable for incandescent gas lighting.

A method has been devised to enable a gas company to determine the candle power of coal gas produced at night as well as by day. A holder 3 feet in diameter and 3 feet high is used, and the flow of gas into it is regulated so that it will just fill up during the night or during the day. Tests made on the candle power of the gas collected in the holder agreed exactly with those made according to the "periodic method," in which readings are taken periodically when the candle power is at a maximum, at a minimum, and at the average.

GLOBES, REFLECTORS, AND FIXTURES.

Having plenty of light available from gas or electricity, manufacturers have increased the variety of materials used in making globes, reflectors, and shades. At one extreme might be put the wicker basket, which, with or without a lining, is suspended from the ceiling as a semi-indirect fixture, or inverted and covered with suitable material makes a shade for a table lamp. At the other extreme is the hammered brass bowl, with or without glass insets, used either for totally indirect or semi-indirect lighting. There is a growing use of floor lamps having very large shades and mounted on standards 5 or 6 feet high. It is replacing the old centre table lamp for family reading; and inasmuch as those using it can all have the light properly directed for reading, it forms a step toward eye protection. There is also a growing trend on the part of architects to call for lighting fixtures that conform to the period of their surroundings.

In school rooms an increasing tendency towards the use of denser glassware and semi-indirect lighting is noticeable; and in general, for both direct and semi-indirect systems, denser glassware is used. Furthermore, the tendency towards constantly increasing candle power in small units has led to a greater use of diffusing media, such as marble and alabaster, and to fixtures carrying several lights burning upright, with small semi-indirect shades. There is evidence of a considerable increase in the employment of the semi-indirect type of fixtures for gas.

A great advance has been made in gas-fittings. The old "goose neck," fastened with a wire, is being replaced by straight pipe tubing with gas-tight adjustable couplings, which make a variety of brackets available.

Reflectors have been developed for converting the ordinary gas "arc" as used in stores and warehouses into a semi-indirect unit —thus meeting the demand for this type of lighting without the necessity of scrapping former fixtures.

PHOTOMETRY.

The measurement of light sources differing in colour value continues to interest the photometrist. Developments have followed two general lines—one the elimination of the colour difference, thereby reducing conditions to those of ordinary photometry, the other the use of the flicker photometer, which has not yet been generally accepted as a solution of the problem.

Secondary Standards.—At the National Physical Laboratory in England there has been completed and described a careful and exhaustive research having for its object the establishment of a set of standards matching in colour lamps operating at the various efficiencies in ordinary use. In this research the colour problem was met by using the so-called "cascade" method, in which a lamp at a given watts per candle is measured against one whose watts per candle differs by an amount which will make the colour difference small enough not to be objectionable. Check measurements were also made, in which the maximum colour difference was encountered. The experience gained from these and other comparisons was that, whereas an observer may be relied upon for constancy of judgment in measuring with an ordinary contrast photometer sources differing by a small amount in colour value, the same constancy in judgment was not obtainable where he colour differences were large. Efforts were made to use the licker photometer; but the results were not satisfactory, and the accuracy was of a different order of magnitude from that found with the other method.

Pentane Standard.—A redetermination at the National Physical Laboratory of the constants of the pentane lamp gave the following as the equation of the candle power:

$$C.P. = ((1 + 0{\cdot}0063\,(8 - e) - 0{\cdot}0008_5\,(760 - b))$$

being the humidity in litres of water vapour per cubic metre of moist air, and *b* the barometric pressure in millimetres. Evidence was obtained that there exists a temperature coefficient in the case of the pentane lamp—a point which had been raised previously at the Bureau of Standards. Apparently the temperature and humidity effects act against one another; and in practice it is the difference between the two which is operative. It is suggested hat if work of the very highest accuracy is to be carried out with lame standards under abnormal humidity conditions, the combined humidity temperature coefficient should be determined for he locality in which the work is to be conducted.

Radiation.—Experiments on the emissivity of metals at high emperatures have given results indicating a change in the emisivity of platinum for wave-length $\lambda = 0{\cdot}65\mu$. This fact, if erified, would influence the constancy of the Violle standard of ight.

Two investigations have been made during the year on the determination of the visibility of radiant energy. One covered the whole visible spectrum, going further into the red and violet than heretofore; the other dealt with the red end of the spectrum only —results being obtained out as far as $\lambda = 0{\cdot}770\mu$.

Calculation.—Methods of calculating the illumination produced y a direct-lighting source are numerous and well known. But in he case of a totally indirect or semi-indirect unit, the calculation s decidedly modified. A method has been proposed in which it s necessary to know only the photometric curve, the coefficient of eflection for the secondary source (usually the ceiling), the disance of the unit below the ceiling, and the height of the ceiling bove the plane of illumination. Roughly, the method involves he consideration of the ceiling as a secondary light source, rearded as made up of a series of circular annuli or rings of uniform ntensity of illumination. The effect of each ring is calculated ndependently.

Nomenclature.—Considerable attention has been given to the ubject of nomenclature during the past year. It has been proosed that the word "lambert" be used in referring to brightness n lumens per unit projected area. The "lambert" is interpreted s the equivalent in appearance to the eye of a surface source mitting one lumen per unit area, in accordance with Lambert's osine law. The following resolution, which was submitted by the Committee on Nomenclature and Standards, has been approved y the Council of the Society:

> *Resolved*, That it is the opinion of this Committee:
> (*a*) That the output of all illuminants should be expressed in lumens.
> (*b*) That illuminants should be rated upon a lumen basis, instead of a candle-power basis.
> (*c*) That the specific output of lamps should be stated in lumens per watt, and the specific output of illuminants dependent upon combustion should be stated in lumens per British thermal unit per hour.

PHOTOGRAPHY.

The use of gas light for taking pictures is increasing; and special mantles have been designed for the purpose.

LEGISLATION.

Calorific Standard.—The Illinois Commission has ruled that in ll parts of the State excepting Chicago a calorific standard of 65 B.Th.U. for gas shall be used. Chicago is to remain under he candle-power standard. The calorific standard has been dopted by the Maryland Public Service Commission. A heating alue of 600 B.Th.U. is specified. It was estimated by the Commission that in the State generally only 6 to 10 per cent. of the gas sed is burned in flat-flame burners. The use of the calorific tandard in gas undertakings does not seem to be growing rapidly England. Only eight companies applied for parliamentary authority during the session of 1915. Four of these companies pplied for a 500 B.Th.U. standard.

Glare.—Extremely bright lamps are no longer allowed on residential streets (especially in front of isolated stores) in Washington, D.C. Regulations adopted prohibit the use of lamps exceeding 00-candle power on streets other than business streets. They lso require a minimum height of 15 feet for all private lamps upported from side walks, and that such lamps are to be enclosed opalescent globes, in order that the eyes of passers-by shall be rotected from glare.

A Bill has been introduced in the Utah Legislature providing r the creation of special lighting improvement districts, under hich the property owners on any street or subdivision may petition the city commission to create such districts and to instal therein lighting systems.

Safety.—The Ottawa (Canada) City Council have recently taken up the matter of all-night lighting of public buildings used for residence purposes. A bye-law has been passed providing that the stairs, halls, and corridors of all apartment houses, hotel, and lodging-houses must be lighted from sunset to sunrise. In places where public safety demands it, there is a growing tendency on the part of municipal authorities to require two independent systems of illumination, so that in case of failures on the part of either the other will be available.

ILLUMINATING ENGINEERING IN GENERAL.

Daylight Saving.—By adopting eastern standard time Cleveland, Ohio, has added one hour to the period of daylight. The result has caused a renewed interest in the so-called "daylight saving movement" in the middle west. In Holland also this movement is being agitated.

The use of light sources imitating daylight is growing, and has been found advantageous not only in clothing, painting, and wall-paper stores and factories, but also in printing and lithographing establishments, paper mills, oil refining plants, cigar factories, &c.

It has been proposed to add to the numerous collections in Berlin a museum of illuminating appliances in which the development from the Seventeenth Century of lamps and other devices for street lighting will be shown.

Luminous Efficiency.—Values of the radiant luminous efficiencies (ratio of the energy radiated evaluated according to its effectiveness in producing the sensation of light to the total energy radiated) of various light sources have been determined, using the method which employs an absorbing solution whose transmission curve is the same as the luminosity curve of the eye. Among the results obtained were:

4 w.p.c. carbon lamp	0·43
0·8-ampère Nernst filament	1·08
6·6-ampère gas-filled tungsten at 0·65 w.p.c.	2·93
Ordinary vacuum tungsten at 1 w.p.c.	1·99
Open burner, gas	0·9
Incandescent mantle, gas	0·5 to 1·2
1·7 ampère mercury arc, Pfund type	30·0

A new experimental determination by two different methods gives for the mechanical equivalent of light a mean value of 0·00162 watt per lumen.

International Commission.—At the meeting of the National Illumination Committee of Great Britain held early in the year ["JOURNAL," Feb. 9, 1915, p. 326] there was considered the question of "Rating of Light Sources in Candle Power or Consumption;" and the following resolution was passed and transmitted to the Secretary of the International Commission on Illumination.

> It is desirable that a uniform international method be adopted for rating and marking all sources of light. It is recommended by the National Illuminating Committee of Great Britain that the matter be considered at the next session of the International Commission on Illumination; and the administration of that Commission is asked to take the necessary steps to bring this resolution to the knowledge of the different national committees, with the view to their co-operation.

LITERATURE.

The war has seriously interfered with many foreign publications having articles on illumination. The French journal, "Science et Art de l'Eclairage," has apparently suspended publication, and other French and German journals were compelled to omit some issues, although they are now appearing regularly.

Chemical Engineering Company's Specialities.

Photographic evidence in plenty is provided by the new catalogue of the Chemical Engineering Company and Wilton's Patent Furnace Company, of Hendon, N.W., of the popularity of their various specialities in gas-works. The firm have been established for a quarter-of-a-century for the manufacture of chemical plants; and that they have been successful in the aim that has always been theirs, of securing efficiency together with simplicity in operation, must be taken as proved by the numerous installations now at work. Wilton's sulphate of ammonia plant, operating by the distillation process, is to be found in gas-works all over the United Kingdom, as well as in other countries; and there is also Wilton's direct process, designed to enable any gas-works, however small, to "turn a present nuisance into a profitable undertaking without in any way interfering with the ordinary process of gas manufacture." Both these systems are described in the catalogue; the complete processes being illustrated by sectional drawings. Then there is Wilton's semi-direct sulphate plant, with which the gas is first washed with sulphuric acid for the recovery of the ammonia, as on a direct plant; but the resultant mother liquor is pumped to a saturator, where it is worked up into sulphate of ammonia in the usual manner with the ammonia recovered from the virgin liquor. The firm further supply crude concentrated gas liquor plant, as well as apparatus for the manufacture of pure anhydrous ammonia, and muriate, carbonate, and nitrate of ammonia. There is, too, a simple arrangement for making household ammonia, which has, among other places, been installed at the Hendon Gas-Works, and for the product of which the North Middlesex Gas Company experience a lively demand.

DIRECT PRODUCTION OF LIQUOR AMMONIÆ FROM GAS LIQUOR.

The Poetter Plant.

An article in the "American Gaslight Journal" of Oct. 18, by Mr. R. W. Hilgenstock, the Chief Engineer of the Poetter Gesellschaft of Düsseldorf, describes the plant which the Company constructs for the manufacture of "aqua ammonia" or liquor ammoniæ from crude gas liquor.

Plant for the production of pure liquor ammoniæ from crude gas liquor is necessarily much more complex than that for the preparation of concentrated liquor, since carbonic acid, sulphuretted hydrogen, and tarry compounds must be entirely abstracted in the former case. In order to dispense as far as possible with the use of lime or soda, the Poetter plant utilizes the ammonia as evolved from the liquor to fix, for the time being, the carbonic acid and sulphuretted hydrogen.

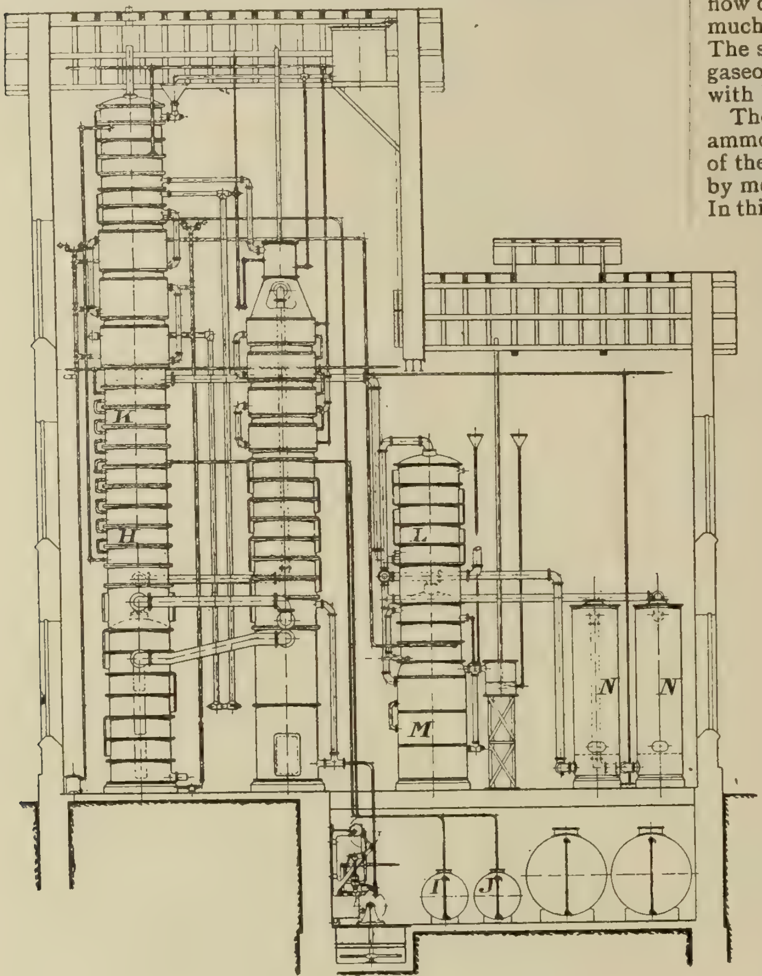


Fig. 1.—General Arrangement of the Aqua Ammonia Plant.

The general arrangement of the plant is shown. The crude liquor which is to be worked up is pumped into the feed tank A, which serves also to render uniform the flow of liquor from this tank to the carbonic acid extractor B. This consists of three rectangular chambers, in which the liquor is heated to from 208° to 212° Fahr. The temperature of decomposition of carbonate of ammonia is in the neighbourhood of 200° Fahr.—therefore a sufficiently high temperature for the bottom chamber. But the other two are heated to nearly 212° Fahr., in order to ensure complete decomposition. A great deal of ammonia is driven off at this temperature, along with the carbonic acid; but this ammonia is recovered by absorption in liquor in a number of absorption chambers placed above the heating chambers. In these chambers the absorption of the ammonia is complete, and the waste gases which escape from them consist only of air, carbonic acid, sulphuretted hydrogen, and pyridine. A vacuum breaker C is attached to the apparatus, to admit air in the event of negative pressure arising therein.

The hot decarbonated liquor flows from the carbonic acid extractor into the top of the still D, in the upper sections of which all the volatile ammonia is driven off with any remaining carbonic acid and sulphuretted hydrogen. In the lower section, the liquor is thoroughly mixed with milk of lime, which is pumped up from the lime-mixer E. The mixture of liquor and lime passes into the secondary still F, consisting of a number of sections, in which the "fixed" ammonia is liberated from the liquor, and, with the steam and vapours, passes into the condenser G, along with the "volatile" ammonia and vapours that are liberated in the primary still.

The condenser, which is on top of the primary still, consists of a number of chambers, in which the steam is condensed, and from which nearly dry gaseous ammonia flows out to the washer H. Clean water enters the upper section of the washer, and flows through it in the reverse direction to the stream of gaseous ammonia. A saturated solution of ammonia is, therefore, produced in the last section of the washer, and this retains the small quantities of carbonic acid and the sulphuretted hydrogen associated with the gaseous ammonia. The ammonia leaving the washer, therefore, contains only traces of these impurities—the flow of clean water to the washer being so regulated that only so much ammonia is absorbed as will just suffice to retain them. The sufficiency of the flow of water is ascertained by testing the gaseous ammonia at the outlet of the washer from time to time with lime water and a solution of lead acetate.

The effluent from the washer consists of a saturated solution of ammonium carbonate and sulphide. It is run into one or other of the cylindrical tanks I, from which it is driven in a thin stream by means of compressed air into the carbonic acid extractor B. In this extractor the carbonic acid and sulphuretted hydrogen are liberated, as from the crude liquor, and the ammonia is re-absorbed by the liquor. A catch washer K, containing a solution of caustic soda of 1·114 specific gravity, is employed to absorb any traces of carbonic acid or sulphuretted hydrogen which escape absorption by the water in the washer H. The spent soda solution from the lowest section of the catch washer, being only small in quantity, is run into the gas liquor well. The gaseous ammonia leaving the catch washer is pure, except that it contains some tarry matters and pyridine, for the removal of which it next traverses an oil-washer L, in which it is washed with a heavy tar oil. It then passes to the absorber M, which is similar in construction to the carbonic acid extractor B; but (in place of steam) cooling water is circulated through it to get rid of the heat due to the absorption of the ammonia in the distilled water fed into the upper part of the absorber at such a rate that the resultant liquor ammoniæ which flows out continuously is of the desired strength. The condensed steam from the heating chambers of the carbonic acid extractor provides the distilled water.

The liquor ammoniæ thus produced is the technically or commercially "pure" product. When chemically pure liquor ammoniæ has to be produced, the gaseous ammonia is further purified by passing it through two filters charged with charcoal, and then through two filters charged with bone black. The filters, N, are wrought-iron vessels; and the filtering material in them can be regenerated several times—the ammonia contained in it being first driven off by steam into the lowest section of the carbonic acid extractor, where it is absorbed by the crude gas liquor.

The absorber on the continuous system may be replaced by two absorbers, each consisting of an upper and a lower vessel. These absorbers are worked in series; the order being reversed when the liquor ammoniæ in the lower vessel of the second, having reached the desired strength, is discharged, and replaced by the liquor from the upper vessel, into which clean water is then run. A small plant with reversible absorbers, thus arranged, is shown in fig. 2. The vessels described and illustrated as superposed may be arranged side by side, if the height of the building does not admit of the former arrangement, as in the plants shown in figs. 2 and 3.

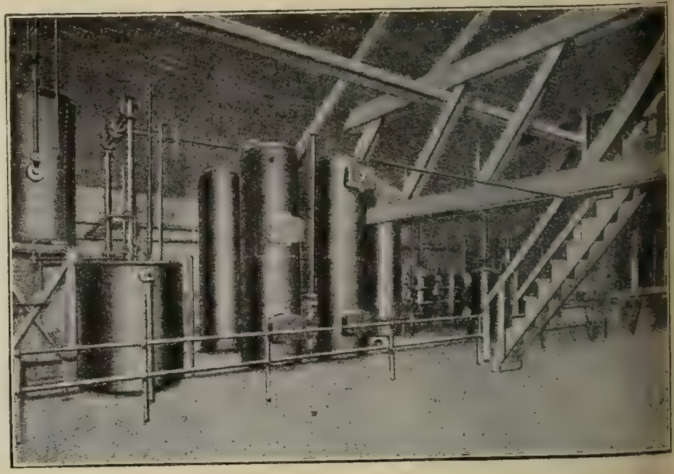


Fig. 2.—General Arrangement of Small Plant, with Reversible Absorbers

The following is a conversion (to English weights, measures, and money) of the author's table in metric quantities and German money, of the working expenses and profit of a large plant on the system described:

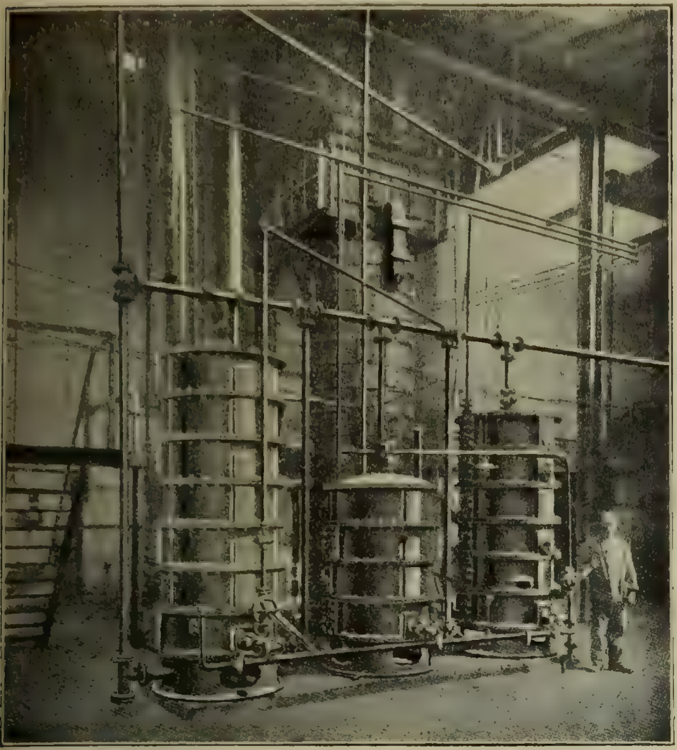


Fig. 3.—Arrangement of Water, Alkali, and Oil Washers side by side, and Still with Condenser on Top in the Background.

A YEAR'S WORKING COST OF A LIQUOR AMMONIÆ PLANT TO WORK UP 22,000 GALLONS OR (SAY) 100 TONS OF GAS LIQUOR PER DIEM.

The gas liquor is assumed to contain about 2 per cent. of ammonia (*i.e.*, to be of about 9·2 "ounces" strength) and the plant to work for 300 days in the year. Therefore the quantity worked up is 30,000 tons of liquor per annum, containing 600 tons of ammonia.

Outgoings.

1. Interest and depreciation charges :	
(*a*) On building costing £2000 at 8 per cent. . . .	£160
(*b*) On plant costing £3000 at 15 per cent. . . .	450
2. Cost of steam : A ton of liquor requires 0·275 ton of steam, requiring for its production 0·275 ÷ 7 ton of coal at 20s. 6d. (= £1·025) per ton. $\frac{30,000 \times 0{\cdot}275 \times 1{\cdot}025}{7}$ = £1208, or say.	1,200
3. Cost of lime : A ton of ammonia requires 0·7 ton of good lime, costing 17s. (= £0·850) per ton. $600 \times 0{\cdot}7 \times 0{\cdot}85$ =.	357
4. Cost of cooling water : A ton of liquor requires 2 tons of water, costing 0·6d. per ton (= about 2⅜d. per 1000 gallons). $\frac{600 \times 2 \times 0{\cdot}6}{240}$ = ...	150
5. Cost of soda : A ton of ammonia requires 0·0125 ton of sodium hydrate (70 per cent.) costing £10 per ton : $600 \times 0{\cdot}0125 \times 10$ = ...	75
6. Cost of oil : A ton of ammonia requires 0·015 ton of oil, costing £17 10s. per ton : $600 \times 0{\cdot}015 \times 17{\cdot}5$=	158
7. Cost of charcoal and bone-black : averages 5s. per ton of ammonia : 600 × 5s. = ...	150
8. Wages : Two operators at 6s. and four labourers at 5s. each = 32s. per diem × 300 = ...	480
9. Miscellaneous expenses : repairs, packing, cleaning, lighting, &c.	60
10. Crude gas liquor at £30 per ton of ammonia : 600 × 30 = ...	18,000
11. Loss : The unavoidable loss is about 3 per cent. of the ammonia	540
Total outgoings . . .	£21,780

Receipts.

The ammonia in the liquor ammoniæ realizes £45 per ton —making for the year's output : 600 × 45 = . . . £27,000

The net profits would, therefore, be £27,000 − £21,780 = £5220 a year.

In the foregoing estimate of expenses, the gas liquor is taken as f.o.b. the works. It might be advantageous to buy the gas liquor in the concentrated state—*i.e.*, of about 90 "ounces" strength, in which case its contained ammonia would be valued at £40 per ton, f.o.b. the works. If "commercially pure," instead of chemically pure, liquor ammoniæ were made, item No. 7 of the outgoings, amounting to £150 per annum, would be saved (but presumably the product would fetch a somewhat lower price).

COKING AND BYE-PRODUCT PLANT AT THE TINSLEY PARK COLLIERY.

The "Iron and Coal Trades Review" of the 12th inst. contained a very interesting article (with fourteen reproductions of photographs) dealing with the new washing, coking, and bye-product plant at Tinsley Park Colliery, Sheffield. Some of the particulars we venture to reproduce.

The Company commenced manufacturing coke in bye-product ovens eleven years ago—employing for the purpose a battery of twenty-five waste-heat ovens of the Simon-Carvès type. Two years later a further battery of thirteen Simon-Carvès regenerative ovens was added. Tar, sulphate of ammonia, and benzol were recovered; and the coal for the ovens was dealt with in a Blackett washery.

About two years ago it was decided to extend the coking installation; and for the new plant a site was selected some little distance from the original batteries, but equally well-placed with regard to railway and other facilities. Such an arrangement necessitated the erection of an entirely new and complete unit; and it was decided to erect a washery with a capacity for treating 75 tons of coal per hour, and forty coke-ovens, together with all necessary machinery and bye-product plant, with provision to extend the plant to fifty ovens. After due consideration of the merits of the various types of plant, the Directors decided upon the erection of a coal washery, Koppers regenerative ovens, and bye-product plant for the tar, sulphate of ammonia, and benzol—the two former products being recovered by the Koppers direct-recovery process.

The small coal is brought from the colliery in waggons, and tipped into an underground bunker at the washery. By means of an elevator it is then delivered on to a fixed screen provided with ⅜-inch square perforations. The screenings go to the shoot of another elevator. The coal above ⅜ inch passes to a revolving screen, which separates it into three sizes—the two larger sizes going to the nut-washer, and the small coal to the second elevator already mentioned. The coal from the nut-washer is flushed on to a shaker screen, which separates it into three sizes of nuts—⅝ to 1 inch, 1 to 1½ inches, and 1½ to 2½ inches—the various sizes being stored in separate bunkers placed over the railway for loading as required. The two larger sizes of nuts slide down spiral shoots when leaving the shaker, in order to avoid breakage, and are furthermore washed with clean water and screened just before entering the railway waggons, so as to improve the appearance of the products. The coal below ⅜ inch is taken by the elevator to a spiral conveyor, which in turn delivers it to the percussive screens, fourteen in number—the arrangement being such that the feed to each is easily and accurately controlled. Here the fine coal below 1/32 inch is removed, and stored in a hopper of 60 tons capacity. The coal passing over the above screens is carried by water into the "fine coal" washer, which (as also the nut washer) is of the pulsating type. The washed coal is carried into drainage bunkers of 600 tons capacity. After the excess of water has been removed, the washed coal (together with the dry fine coal) passes by way of a special type of distributing tables to the disintegrator, where it is crushed in the usual way. Large clarifying tanks in the basement of the building are provided for dealing with the washing water; and they are so effective that it has not yet been necessary to run any water away from the plant, although over 155,000 tons of coal have already been dealt with. From the disintegrator the coal is raised by a bucket elevator to the service bunker—a ferro-concrete structure at one end of the battery of ovens, and of a capacity of 600 tons.

The forty coke-ovens are of the Koppers regenerative type, each capable of dealing with an average of about 6 tons of coal per day. The special features of this type of oven are the provision of a separate set of regenerator chambers for each oven, and the manner of distributing the gas and air required for heating purposes. The arrangement is, in fact, conducive to the greatest economy in consumption of heating gas; indeed, as much as 55 to 60 per cent. of the total gas produced is available for purposes other than the heating of the ovens. The facilities provided for the regulation of the combustion in the heating flues allow of full and complete control of the heating of the ovens. Regular heats throughout the full length of the oven are easily maintained; and consequently an excellent quality of coke, free from black ends, is invariably obtained.

The coal from the service bunker, containing about 10 per cent. of moisture, is fed into the hopper of the charging machine, and thence it is delivered into the compressor box as required. The coal is compressed into the form of a cake by a magnetic stamper. The machine serves the purpose of a combined coal-compressing, charging, and coke-pushing machine, and is of very substantial character. The carbonizing period at present is about 34 to 36 hours. The coke on being discharged passes first through a Darby quencher, and then on to an inclined bench, where the quenching is completed. It is then loaded by hand into waggons. An automatic pump supplies water at high pressure for quenching purposes.

The gas evolved from the coal passes first by way of the ascension pipes into the gas-collecting main, and then through the gas-conducting main to the coolers. These are of the multitubular type, and serve to reduce the temperature of the gas to about that of the atmosphere. By this means the ammoniacal liquor and the heavier tar are all removed. The gas is then drawn by exhausters—which are of the Bryan Donkin Company type—and forced through rotary tar-extractors, where the last traces of tar are removed. The suction on the ovens is controlled by Bryan Donkin governors, adjusted to control the speed of the exhausters as desired. After leaving the tar-extractors, the gas passes through re-heaters, heated by exhaust steam; and in so doing its temperature is raised to about 65° to 70° C. The hot gas is then led into the saturators, where the ammonia is recovered by direct absorption in sulphuric acid, according to the Koppers direct-recovery process.

The sulphate of ammonia formed falls to the bottom of the saturator, whence it is ejected by means of steam or compressed air on to a draining table. The surplus mother liquor runs back into the saturator; and the salt is finally dried in a centrifugal drying machine. The salt falls through a discharge valve into the boot of an elevator, by which it is carried to the sulphate store. Storage capacity for 300 tons of salt is provided.

All the apparatus on the bye-product side is in duplicate; so that in the event of a breakdown of any unit, continuity of working is not affected. The ammoniacal liquor resulting from the cooling of the gas, together with the tar, flows to a connecting tank, whence it is pumped into a separating tank—each then going into its own storage tank. The ammoniacal liquor is distilled with steam and lime in the usual way; and the ammonia passes into the saturator.

The gas, deprived of its ammonia, goes through a final cooler, where its temperature is reduced to the required degree for the efficient extraction of benzol. This product is extracted in the usual way by scrubbing the gas with creosote oil, and then submitting the enriched oil to distillation. Crude benzol of 65 per cent. strength is manufactured; and the plant is arranged so as to utilize the heat in the most economical way possible.

For dealing with the cooling water, open-type cooling frames are provided; while the water for the benzol coolers is treated in a Patterson softener, and subsequently utilized in the boilers. Ample storage capacity for the various products is provided.

The surplus gas is employed for boiler-firing purposes, both at the ovens and also at the colliery, which is some 600 yards away. There are two Lancashire boilers; but only one is needed to work the whole of the plant. A Sugden superheater is fitted to each boiler, and all steam-pipes are covered with Simpkin's sectional slag-wool encased in sheet steel.

The whole plant is well laid out, so that all traffic can be economically dealt with, and the coal and coke undergo a minimum amount of handling. An excellent quantity of coke is produced, and one which is quite suitable for all the purposes for which bee-hive coke has been employed. The yields obtained per ton of coal are, approximately, 70 per cent. of coke, 5 per cent. of tar, 1·4 per cent. of sulphate of ammonia, and 2½ gallons of benzol.

BYE-PRODUCT COKING IN THE UNITED STATES.

[From the "Chemical Trades Journal," Nov. 20.]

A review of the American coking industry in 1914 has just been issued by the United States Geological Survey. One effect of the European war, it is pointed out, has been to throw the United States more completely upon its own resources, and has concentrated attention upon the development of industries that utilize the bye-products of coke—such as the dyes, organic acids, and other derivatives of coal tar, until now largely imported. The steadily increasing use of gas as a fuel and a source of power in internal combustion engines, the growing demand for ammonia as a fertilizer, and for coal tar as a road-making and roofing material, as well as for its chemical and dye derivatives, and at the present time the keen demand for some of the products of benzol used in the manufacture of high explosives, all tend to increase the relative importance of the bye-product coking industry, and forecast a change in economic conditions when all coal will be coked in a manner to save the bye-products.

The production of coke in 1914 was the smallest (except in 1908) since 1905, and amounted to 34,555,914 short tons, valued at £17,667,000. Compared with 1913, when the production was 46,299,530 short tons, valued at £25,785,000, the output in 1914 decreased by 25·4 per cent. in quantity and 31·5 per cent. in value. Of the 34,555,914 tons of coke made in 1914, 23,335,971 tons were beehive coke, valued at £10,051,000, and 11,219,943 tons, valued at £7,616,000, were bye-product coke. The decrease in the production of retort coke in 1914 was 1,494,757 short tons, or 11·8 per cent. The beehive output decreased 10,248,859 tons, or 30·5 per cent. With the exception of two years, 1908 and 1914, the production of bye-product coke has increased each year since the first ovens were completed in 1893. Except in 1909 the percentage of bye-product coke to the total has increased each year; in 1901 it was 5·4; in 1910 it was 17·1; in 1912 it was 25·3; in 1913 it was 27·5; and in 1914, 32·5.

In 1913 there was a net increase of 420 in the total number of ovens, although 2833 ovens, all of the beehive type, were abandoned during that year. At the close of 1914 there were 2895 less ovens in existence than at the beginning of the year. There were 192 retort-ovens constructed during the year, out of a total of 799; so that the new installations of beehive type aggregated 587. The total number of ovens and retorts in operation in the United States decreased in 1914 from 102,650 to 99,755—a net loss of 2895. As the retort-ovens showed an increase of 121, there was a net decrease of 3016 in the number of beehive ovens in existence in 1914 compared with 1913. In addition to the number of ovens abandoned during 1914, there were 45,117 idle, of which 667 were retorts and 44,450 were beehive ovens. The new ovens in course of construction at the close of 1914 numbered 1249, of which 644 were retorts and 605 were beehive ovens.

The first ovens of the retort type constructed in the United States comprised a plant of twelve Semet-Solvay ovens with recovery apparatus at Syracuse, built in 1893, primarily for the recovery of bye-products for use in connection with the chemical works of the Solvay Process Company. The second bye-product plant constructed was one of sixty Otto-Hoffmann ovens completed the latter part of 1895 at Johnstown, Pa. In addition to the increase in the number of retorts, the installations of the present day are of much larger dimensions, and of greater capacity, than formerly. The original ovens at Syracuse had a charging capacity of 4·4 tons of coal; and the time required for coking was 74 hours. The present-day bye-product ovens have capacities ranging from 10 to 16 tons of coal, and make furnace coke in 16 to 18 hours. These developments have been accompanied by marked improvements in bye-product recovery and in the manufacture of ammonia.

Still another marked development in bye-product oven practice is in the adaptation of the surplus gas to the illumination of cities and towns. In the earlier days the ovens produced only a small and irregular quantity of surplus gas, which was also irregular in quality. To-day bye-product ovens in the States sell more than 50,000,000 cubic feet of gas a day for domestic purposes. Almost the entire supply of gas in some cities is from retort-ovens.

The total value of the residuals produced at bye-product recovery ovens the last two years is shown in the following table:

Product.	1913.		1914.	
	Quantity.	Value.	Quantity.	Value.
Gas . thousands cub. ft.	64,553,941	$5,694,691	61,364,375	$6,009,583
Tar . . . . gallons	115,145,025	2,830,158	109,901,315	2,867,274
Ammonia, sulphate or reduced to equivalent in sulphate . . lbs.	173,342,349	5,324,444	170,763,906	4,696,590
Ammonia liquor, gallons	4,102,448	537,413	5,938,233	658,497
Anhydrous ammonia. lbs	a28,663,936	a2,135,656	a25,370,509	a2,300,137
Other bye-products .	—	403,579	—	b997,007
Total value of bye-products	—	16,925,941	—	17,529,088
Coke . . short tons	12,714,700	48,637,852	11,219,943	38,080,167
Grand total . . .	—	65,563,793	—	55,609,255

a Mainly ammoniacal liquor sold on pound basis of ammonia. b Mainly benzol.

Imports of Coal-Tar Products.

It has been contended that the development of the bye-product coking industry would have shown more rapid progress if markets for the bye-products had been assured. This contention pertains principally to the coal tar and its products, as there is no difficulty in disposing of the surplus gas, and there is practically at all times a fair demand for ammonia. The total value of the domestic coal tar produced in 1914 from retort-coke ovens was £574,000. No information is available regarding the quantity and value of the products obtained from this tar, as in going to the distillers it becomes mixed with the coal tar from gas-house retorts; and even if the total quantity and value of coal-tar products were obtainable, it would be practically impossible to differentiate those obtained from retort-oven tar from those obtained from gas-house tar. For several years the coal-tar products imported into the United States have amounted approximately to £2,000,000 annually. In 1913 the total value of coal-tar products was £2,200,000, of which colours and dyes made up nearly 80 per cent. In 1914 the value of the coal-tar products imported increased to £2,536,000, of which colours and dyes represented nearly 90 per cent. This increase in the value of imported colours and dyes is probably to be ascribed not so much to increase in quantity as to increase in value after the beginning of the European war in August, 1914. Since that time the imports of dye materials, which come mainly from Germany, have been greatly restricted in quantity and considerably increased in value.

The kinds of coal-tar products imported, and the value thereof, during the last six years are shown in the following table:

Year.	Salicylic Acid.	Alizarine and Colours or Dyes, Natural and Artificial.	Aniline Salts.	Coal-Tar Colours or Dyes, not Specially Provided for.	Coal Tar, all Preparations, not Colours or Dyes.	Benzol, Toluol. &c.
	Value.	Value.	Value.	Value.	Value.	Value.
1909	—	$1,191,874	$553,503	$6,431,767	$693,608	$960,724
1910	—	430,393	501,369	5,867,331	594,252	962,232
1911	$3,480	996,794	410,193	6,444,595	659,407	1,128,409
1912	9,543	1,514,344	354,226	7,204,453	659,305	998,767
1913	2,969	1,493,840	323,420	7,253,788	702,721	1,186,090
1914	9,245	4,250,027	180,905	6,868,818	556,614	813,710

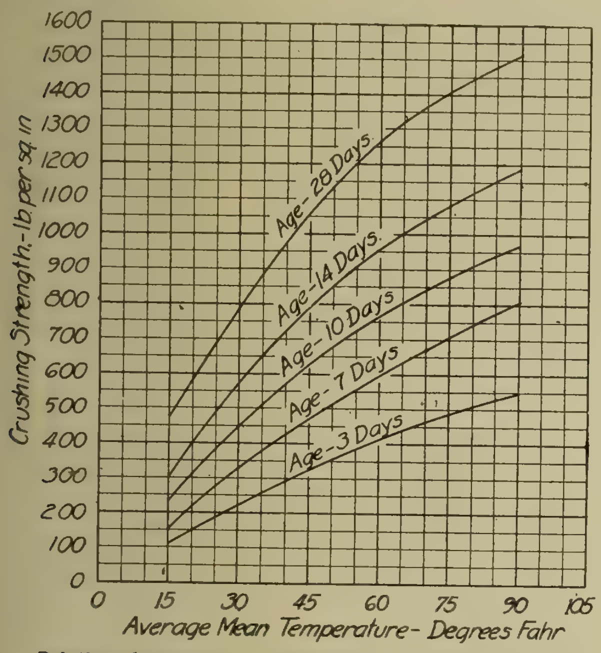
INFLUENCE OF TEMPERATURE ON THE STRENGTH OF CONCRETE.

By A. B. M'Daniel.

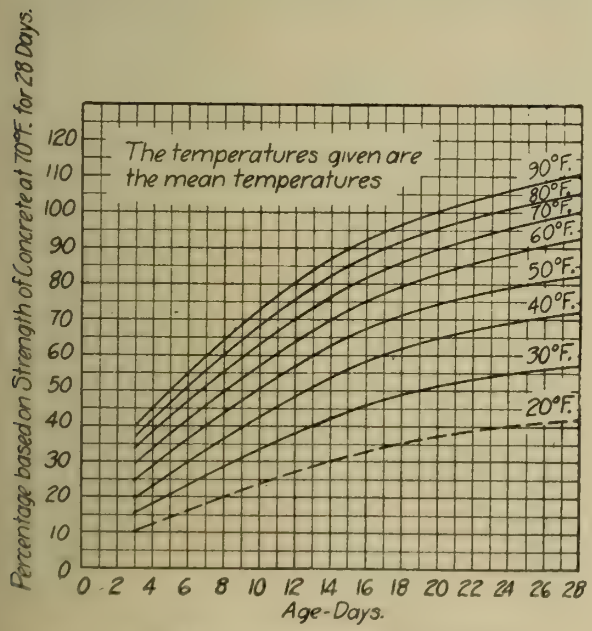
The tests, of which the following is an abstract report, were made at the University of Illinois, U.S.A., and are contained in "Bulletin," No. 81, of that authority.

As to the materials used, the test specimens were made with "Universal Portland Cement," which had passed the requirements of the standard specifications of the American Society for Testing Materials. The sand was all clean and well-graded—having a density of 1·79, a specific gravity of 2·65, and containing 32 per cent. of voids. The crushed limestone was of good quality.

All the concrete was composed of one part of cement, two parts of sand, and four parts of stone by weight—corresponding to one part of cement, 2·2 parts of sand, and 3·6 parts of stone, by volume. The test specimens were formed as cylinders 6 inches diameter and 6 inches high.



Relation of Strength to Temperature for Different Ages.



Percentages of Strength for Different Temperatures.

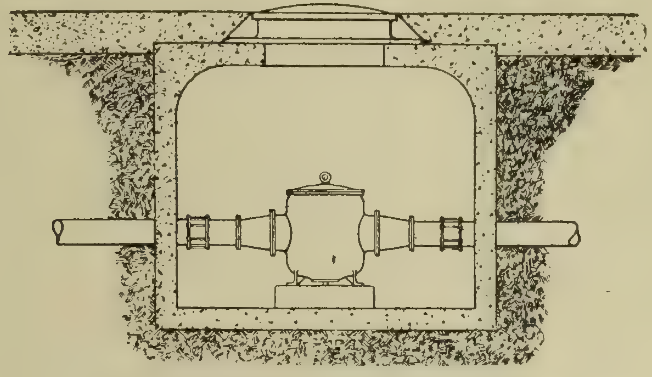
From the results obtained—illustrated by curves and tables in he original—it is believed the following general conclusions are ustifiable. Under uniform temperature conditions, there was an ncrease of strength with age within the limits of the tests. For ny temperature, the rate of increase decreases with the age of the pecimen; and this rate of increase is less, correspondingly, at the ower temperature conditions. For the specimens tested, under ormal hardening temperature conditions of from 60° to 70° Fahr., he compressive strength of the concrete subjected to a uniform emperature at the ages of 7, 14, and 21 days may be taken as pproximately 50, 75, and 90 per cent. of the strength at 28 days espectively. For lower temperatures, the percentage values are ess; and for higher temperatures, they are higher.

Concrete maintained at a temperature of 60° to 70° Fahr. will at the age of one week have practically double the strength of the same material if kept at a temperature of 32° to 40° Fahr.

The two curves reproduced may be used to determine the representative strength of concrete similar to that taken for the tests, for various temperature conditions, and for ages up to 28 days. They may also be used, with a fair degree of accuracy, to ascertain the relative strengths which concrete of ordinary practice may be expected to attain at the different temperatures indicated.

MEASURING THE GAS SUPPLIED TO PANAMA-PACIFIC EXPOSITION.

When the Pacific Gas and Electric Company contracted to furnish gas to the Exposition grounds, it was necessary, the "American Gaslight Journal" points out, to measure the total quantities supplied to the Exposition and to the "Zone;" and the measurement had to be made in pipe-lines carrying from 30 to 50 lbs. gauge pressure.



Cross Section of the Underground Pit showing the Thomas Meter installed in the Gas-Line.

Thomas meters were chosen for the work (to be installed in underground pits), which give results directly in standard cubic feet, regardless of variations in pressure. The pits containing the housings are about 500 feet distant, one in the line supplying the Exposition proper, and the other in the line to the "Zone." The Thomas meter measures electrically the heat required to raise the temperature of the flowing gas 2° Fahr. The heat capacity of the standard unit—that is, the quantity of heat required to warm a standard cubic foot through a known temperature range—remains essentially the same even when the pressure and temperature of the gas change; so the meter dial and chart register standard units of gas whatever the pressure, temperature, or volumetric conditions. No corrections need be applied for gas temperature, pressure, or gravity, or for barometer reading; and the meter is entirely automatic, requiring very little attention or care.

RECOVERY OF MANTLE ASH.

In a recent issue of the "Journal des Usines à Gaz" [No. 9, 1915, p. 151], Heer J. van Rossum du Chattel, the Director of the Amsterdam Gas-Works, has given some particulars as to the recovery of the rare earths from spoilt or used mantles. It is admitted that such recovery will have any economical value only when it is applied on a very considerable bulk of material. Recoverable mantle ash occurs in the course of manufacture or in gas undertakings where burners are maintained in large numbers. Putting aside the former, it may be mentioned that the practice at Amsterdam is to provide boxes for the collection of used mantles by workmen engaged in attending to burners. The contents of these boxes are transferred once a week to a single central receptacle and allowed to accumulate there to a total weight of about 25 kilos (55 lbs.). The powder is sieved free from fragments of steatite, &c., and is either disposed of as it is or converted into nitrate of thorium in the works laboratory.

Unfortunately, Heer du Chattel is silent as to the time during which (say) 25 kilos of mantle ash are accumulated, and no data are given of the net results, in working, of this minor economy. It is stated, however, that material for the impregnation of 270 new mantles is obtained from 1000 used mantles. In converting the ash into nitrate of thoria the method recommended is the usual one of solution by digestion at a temperature of about 200° C. (380° Fahr.) with strong sulphuric acid, followed by throwing down the thoria, &c., with oxalic acid, washing and drying the precipitated oxalates at 130° to 140° C. (260° to 280° Fahr.), and finally converting into nitrate by boiling with nitric acid of 1·4 specific gravity, and evaporating the acid. The salt may require the addition of cerium nitrate before it is fit for use.

The will has been proved of Mr. Edward Allen, of Liverpool, who left estate of the gross value of £7826.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Imported Incandescent Gas-Mantles.

Sir,—The weekly paper, "John Bull," is not exactly a classic, especially on the conduct of the incandescent mantle trade; but I do not think the paper from which you quote the extract under the heading "Flying False Colours" [*ante*, p. 368] is far wrong in its statements. I should, however, like to be permitted to make a few remarks on the incandescent mantle trade when it was openly German, and German of a most aggressive kind. I mean the time, previous to the war, when the British market was flooded with German mantles, and the poor British manufacturer seldom had a dog's chance of doing any business.

As the Technical Director of a British Incandescent Mantle Manufacturing Company, I have been through the mill, and can speak feelingly and with authority.

When I refer to British-made mantles, it is, of course, understood that manufacturers in this country are practically dependent for all the high-quality raw material, and for the matter of that for the necessary apparatus, on the Germans. Even with this handicap, we could have paid our way had we met with even a little patriotic encouragement from the public, and especially the gas companies.

We made really good mantles, had a staff of most excellent expert girls, and the best apparatus we could procure. Our standing charges were low, and the directors (three of whom were good technical men), understanding the business thoroughly, devoted much time and attention to turning out mantles of a high standard of quality. But we could not make any headway. German competition killed us; and yet they could only undersell by about 1s. per gross at the maximum. This, however, turned the scale in the Germans' favour when balanced by that highly autocratic individual—the company's purchasing storekeeper.

You would scarcely credit it, but a gas company from whom we obtained the gas for our operations, and to whom we paid considerably over £200 per annum, assured us that it "was with extreme regret that they could not use our mantles," which we were prepared to make according to their specification and under their control. Reciprocity in trade was foreign to their calculations; and the fact that we were employing British labour in a very poor district seemed to exert no influence whatever.

Well, this state of affairs became rather irksome; so I took a little trip to Germany and interviewed my erstwhile friend, the manager of the Deutsche Gasglühlicht Aktiengesellshaft," in Berlin, with the idea of endeavouring to get to the bottom of matters as to the power these Germans had to undersell the British manufacturers, and to reduce them to despair. And I will repeat the manager's statement as well as I can remember it. Be it said that he was extremely candid and cordial, as befitted the position of top dog.

I was permitted to visit and thoroughly inspect his large and perfectly appointed works; but I failed to see that fundamentally they differed from our own, excepting on the score of the enormous quantity of mantles being turned out daily.

Said my friend, with a merry twinkle in his eye and a comfortable oscillation of his ample paunch:

> "You Englishmen, as far as the incandescent mantle business is concerned, have been asleep. We in Germany were adopting the discovery of Von Auer years before your people realized its possibilities; and when you did make a start you muddled it, and upset the gas companies by floating a company with a preposterous capital, out of which the promoters no doubt made a large sum—handicapping at the start the price at which the mantles could have been put on the market, and have been made immediately popular.
>
> "Then you permitted us to spreadeagle Brazilian monazite sand; and you now have to beg it or its products from us—naturally at our price. This sand was in the open market, and you missed the opportunity. But what surprised us later was the fact that you permitted us to acquire the Travancore sand, which was found in a British possession.
>
> "Regarding the underselling, having no protective tariff, and looking at the backward condition of the industry in your country, there was a nice comfortable opening for us; and you must not blame us if we took advantage of it.
>
> "Frankly, we did not make much profit by the export trade; but you know we obtain a much higher price at home, and this amply paid us, because, protected as we are by import duties, we feared no competition, and we owned the sand.
>
> "We were determined to capture your market both in the British Isles and in your Colonies; and even if we lost by our export trade, it would only be temporarily, as we knew that one by one your British manufacturers would succumb to the competition and leave the land open to us.
>
> "Naturally, it was easier for us to export; but we went further, and either established factories in your country or subsidized undertakings. The fact that the exported mantles necessarily have the imprint 'Made in Germany,' did not appear to affect you. Your people wanted cheap mantles; and as long as they were cheap, you were indifferent as to their source of origin.
>
> "But now my friend we will go out and have a glass of Munich beer together, and afterwards I will show you another factory. But take my advice: Shut up your own and become agents for us. It will pay you better."

And I quite think that he was perfectly right! F. D. Marshall.

19, *Queen Anne's Chambers, S.W.*,
Nov. 19, 1915.

Fuel Economy from the National Standpoint.

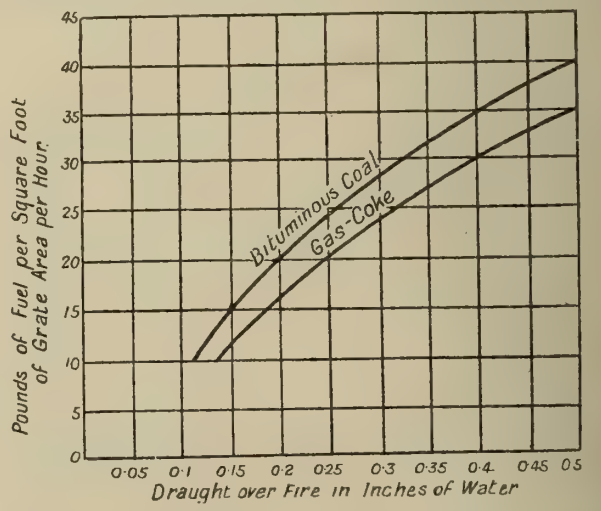
Sir,—In an appeal primarily addressed to householders, to "Save Your Coal for Your Own and Your Country's Advantage," the use of gas coke wherever possible, instead of coal, is commended as a patriotic duty by the Parliamentary War Savings Committee. In their printed appeal the Committee point out that "the more coke is used the greater will be the production of the bye-products which are required for making explosives for the Army and Navy." Coming as it does at a time of the year when gas-works authorities are looking forward to the period of maximum demand for gas, this appeal is particularly opportune; and it might with advantage have been addressed also to the larger consumers of fuel for trade purposes, who individually in their business capacity are each likely to consume considerably more coke than the individual householder, whose requirements are in most cases very much smaller, and therefore of less importance as a coal-consuming unit of the community.

At many of the more important gas-works the output of coke is, to some extent, controlled by increasing or decreasing the manufacture of carburetted water gas in its relative proportion to that of coal gas, as carburetted water-gas plant is a consumer (not a producer) of coke. The residuals from which the much-required bye-products are derived are, however, obtained only in the process of coal-gas manufacture. In order to meet the urgent demand for these derivatives, the production of coke resulting from the increased manufacture of coal gas will far exceed the usual winter demand; so that, as a necessity, fresh outlets for coke will have to be found. Steam-users, perhaps, represent the largest fuel consumers in this country; and it is, therefore, of interest to examine what may be done to further the Committee's suggestion in this direction. It is well known that gas coke or breeze is used exclusively in comparetively small steam-plant installations where smokeless combustion is imperative, and where the relatively high cost of evaporation with smokeless coal is prohibitive. But steam-users generally may be interested to learn that on more than one individual plant, and those outside gas-works, the daily consumption of this class of fuel often amounts to 30 tons or more, showing its further use in installations of considerably greater size and importance. Municipal and company controlled electric power stations are now among the largest consumers of coke fuel—a fact sufficiently indicative that loads subject to sudden and heavy intermittent variation may be safely dealt with by steam-generating plant fired with gas coke.

Considered from the thermal standpoint, the saving that would accrue to the country if all the coal suitable for being carbonized were so treated would be very great. Consumed in a modern turbine electric generating station, 1 ton of coal, on the average, is converted into about 746 B.T.U.—each unit having a thermal equivalent of 3420 B.Th.U., representing a total of approximately 2½ million B.Th.U. The same coal carbonized under modern conditions would produce 12,000 cubic feet of gas, having a calorific value of 520 B.Th.U. per cubic foot, or a total of 6 million B.Th.U. To this has to be added the thermal value of the combustible bye-products—viz., 10 cwt. of coke, capable of developing 12,500 B.Th.U. per pound, and 3 gallons of tar—making a grand total of over 20 million B.Th.U. per ton of coal so treated.

To the steam-user the question of substituting coke fuel for coal is usually one of capacity. The relative cost of evaporation with smokeless Welsh coal and coke, even at the normal difference in price, is invariably in favour of coke; while the latter fuel can usually compete successfully, in the matter of cost, with the higher-priced bituminous steam coal, and it has the additional advantage of being smokeless.

On the question of the evaporative capacity of steam-boilers fired with coke and breeze, the London Coke Committee, in their endeavour to promote the use of coke fuel, have collected data which are useful for comparison with statements of results obtained in coal-fired installations. Experiments conducted under the direction of the Committee have shown that the maximum rate of combustion, and therefore the greatest steaming capacity, is attained with coke graded to pass through a 2-inch square mesh-screen and over a ¾-inch screen of similar section. The diagram below indicates the rates for various degrees of draught met with in ordinary installations working under natural-draught conditions. Evaporative tests conducted by the Coke Committee confirm those of various boiler-makers—viz., that 1 lb of average gas coke, as produced in London gas-works, suitably graded, will evaporate the equivalent of 10 lb. of water from and at 212° Fahr. This figure, taken in conjunction with the rate corresponding to the draught available, will enable anyone to estimate the proportion of coke which it is possible to use on any steam plant without jeopardizing its steaming capacity.



The Coke Committee's experience is, that while many steam plants re working at or beyond their normal capacity during certain periods, very large number are invariably steaming well within their maxinum power when fired on coke fuel exclusively. This is evidenced by he number of stationary and road-locomotive boilers now being fired n coke, to the total exclusion of coal, without any modification whatver of existing draught or furnace conditions. In regard to cokereeze—a fuel which bears to coke the same relation as slack bears to oal—the ash content varies, like that of coal slack, within the same imits. Relatively cheap breeze is a useful diluent to small Welsh oal, and is so used on hand-fired boilers; the average cost of the nixture being reduced in proportion to the quantity of breeze used, vhile the smokeless characteristic of the fuel is not impaired. Fired lone on suitable forced-draught grates or mechanical stokers, rates of ombustion exceeding 30 lbs. per square foot per hour are maintained; vhile a safe evaporative value for the purpose of estimating output vould be 5 lbs. to 6 lbs. of steam per pound of breeze as fired.

The relatively high evaporative value of gas coke having an average alorific value of 12,500 B.Th.U. per pound, as compared with bituninous coal of the same (or greater) heat value, is to some extent explained by the very small proportion of hydrogen contained in the ormer (about 0·5 per cent.) and its comparatively high radiant fficiency. The latter invaluable characteristic of coke fuel may be eadily gauged when fired where fuel economizers are installed, as the ercentage of saving effected, due to the economizers, rarely exceeds per cent.; while with coal as fuel, as much as 15 per cent. saving is ften so effected. In steam-plant installations economizers are exceponal; but the extent of their utility—unquestioned where raw coal the staple fuel—is a reliable index of the inefficiency of coal as comared with coke for steam-raising purposes.

E. W. L. Nicol.

84, *Horseferry Road, S.W.,*
Nov. 19, 1915.

Price of Pitch in London.

Sir,—We have been subscribers to the "Journal" for many years, nd have grown to regard the prices quoted therein as reliable as care nd truthful information could establish. During the past few months, owever, we are sorry to say that the prices of pitch given under the ondon section are beyond our comprehension. As most people in the rade know, we follow the course of the article practically daily. We ransact important business frequently, and export large quantities to e Continental markets as well as import from across the Atlantic.

Basing on your weekly reports during September and October, we rrive at an average of 26s.; but, according to our transactions and ur records, we arrive at an average for September and October of 20s. Vith such a difference between your published figures and our own, e feel sure that you will not be surprised if we are anxious to discover e cause; and we may say that inquiries we have made in the trade onfirm very closely our figures. We therefore venture to address you, the hope that you will be willing to give some justification for your gures.

May we say that a London price, in our opinion, is not a price obtained y selling delivered to a foreign port, and calculated-back to a price at e London works, by deducting estimated freight and other expenses, hich have yet to be determined, and in most cases recently have reatly exceeded estimates.

Even if such a method be adopted, obviously care should be taken base on the current rate of exchange; otherwise the resulting price ill be several shillings too high.

We, however, respectfully submit that London prices should be based n transactions on London terms.

We should not have troubled you had the difference in question been, our opinion, moderate and reasonably possible; but such a great ariation seems to us impossible unless there is some fundamental difference in methods, or some error has been made.

We hope that this letter will be the means of solving what seems to e an enigma.

Blagden, Waugh, and Co.

4, *Lloyd's Avenue, E.C.,*
Nov. 22, 1915.

Unfortunately, the above letter came to hand yesterday afternoon, too late for any inquiries to be instituted on which to found a reply to our correspondents.—Ed. J.G.L.]

REGISTER OF PATENTS.

Mixing Air with Gas for Lighting and Heating Purposes.

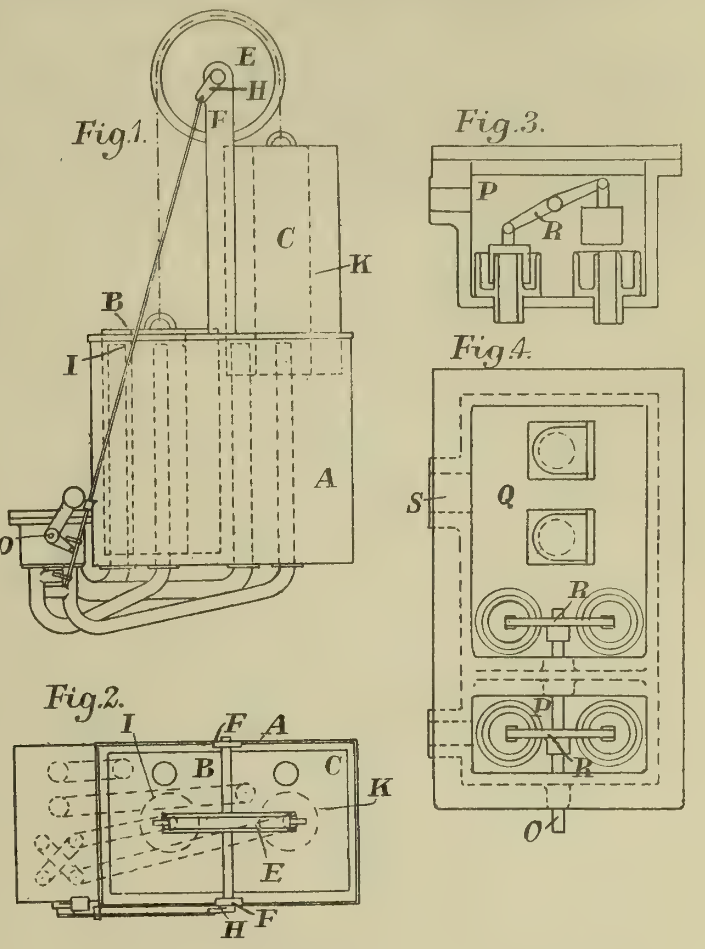
Gee, B., and M'Intire, C. S., of Victoria Street, S.W.

No. 20,464; Oct. 2, 1913.

This invention relates to an apparatus for mixing combustible gas nd air in bunsen and similar burners—enabling the gas, by its initial ressure in the main, "to deliver a predetermined quantity of air into he delivery pipes, and so make a mixture as nearly as possible that ecessary for complete combustion."

Fig. 1 is a side elevation of the complete apparatus. Fig. 2 is a lan. Fig. 3 is a section of the valve-box for the supply of gas. Fig. 4 a plan of the gas supply valve-box and gas and air mixing chamber vith the top cover removed.

The iron tank A is filled with water up to within a few inches of its op; and B and C are two bells arranged to rise and fall alternately the tank. They are open at their lower ends, and connected by a hain passing over a grooved pulley E mounted on a spindle carried y upright supports F. The drums (for the supply of air) carry inside hem, and attached to their tops, two smaller drums I K, also open at heir lower ends. They are the gas-drums in which the pressure of he gas from the supply mains is caused to operate the whole apparatus. Pipes which pass through the bottom of the tank and up above the water level inside the gas-drums allow the gas to flow in from the gas-valve chamber P and out into the mixing chamber Q. Two other pipes reaching above the water level inside the drums B C allow the air to pass from these drums into the chamber Q. The valves are operated by a crank H, actuated by turning the wheel E. A rod connected to the crank carries at its lower end two tappets, which alternately engage with a part of a lever fixed on the valve spindle O.



Gee and M'Intire's Gas and Air Mixer.

The valve-box (fig. 4) is divided into two parts—one of which forms the gas admission box, while the other admits gas from the main. The other portion of the box Q forms the mixing chamber for the gas and air. It contains two valves for gas connected to the valve spindle O by rocking levers R; and the two valves in the gas-chamber are also similarly connected to the valve spindle O. These valves consist of small drums dipping into cups filled with mercury (as shown in fig. 3), the gas passing through a down pipe in the middle of the cup. The chamber Q also contains two air-valves, which allow the air to pass from the drums B C into the chamber. These are simply clack-valves and are not mechanically operated. Two similar valves, opening inwards, are fixed on the air-drums B and C, and act as inlet valves. The mixed gas and air passes out at S to the burners.

When the valve levers are in the position shown, one pair of valves will be open—the small drums being lifted out of the mercury—while the other pair will be shut. Gas under pressure will then pass into the gas-drum I, causing it to rise, and at the same time will pass out of the drum K into the gas and air mixing chamber Q. As the gas-drum I rises, it will carry with it the air-drum B, which will fill with air through its automatic inlet valve, and the air-drum C will at the same time descend and deliver its charge of air into the mixing-chamber Q. When the rising and falling drums reach the end of their stroke, they will have turned the wheel E and crank H, and the lower of the tappets on the rod will have thrown over the valve lever, thus closing the first set of valves and opening the second set. The operations will now be reversed; the drums C and K will rise, and B and I will fall—thus keeping a steady stream of gas and air flowing through the mixing chamber Q and out into the delivery pipes at whatever speed is required.

Meter for Automatically Registering the Flow of Liquids or Gases.

Clark, A., of Langley Green, Birmingham, and Whitworth, H., of Cradley Heath, Staffs.

No. 20,793; Oct. 9, 1914.

This invention relates to a combination apparatus (for automatically registering accurately the flow of fluids, liquids, or gases at any pressure, velocity, and specific gravity) which consists of a cylinder having two concentrically arranged shafts passing through it and carrying piston plates which act alternately—the position of rest of one plate being between the inlet and exhaust ports of the drum.

The claim advanced is for the combination and arrangement of the following apparatus: Two closed cylinders or drums each fitted with two plates, each provided with a tubular portion mounted on independent spindles to which separate cams and ratchet wheels are attached; an adjustable swing lever for engaging with the cams, and moving the plates at certain positions of the plates, inlet and outlet ports to each cylinder positioned as required—the cylinders being mounted on a casting which is formed with inlet and outlet channels.

Manufacture of Substituted Products of Toluene.

Ransford, R. B.; a communication from Leopold Cassella and Co., G.m.b.H., of Frankfort-on-Main, Germany.

No. 16,317; July 8, 1914.

This invention relates to the production of tetrachlorotoluene on a technical scale, and the conversion thereof into tetrachlorobenzolchloride. The claims made for the invention are:

1. The manufacture of tetrachlorotoluene by chlorinating toluene in the presence of anhydrous ironchloride or iron.
2. The manufacture of tetrachlorobenzolchloride, which consists in chlorinating tetrachlorotoluene at temperatures considerably lower than its boiling temperature, and preferably from 100° to 130° C., and also preferably in the presence of light or ultra-violet rays.

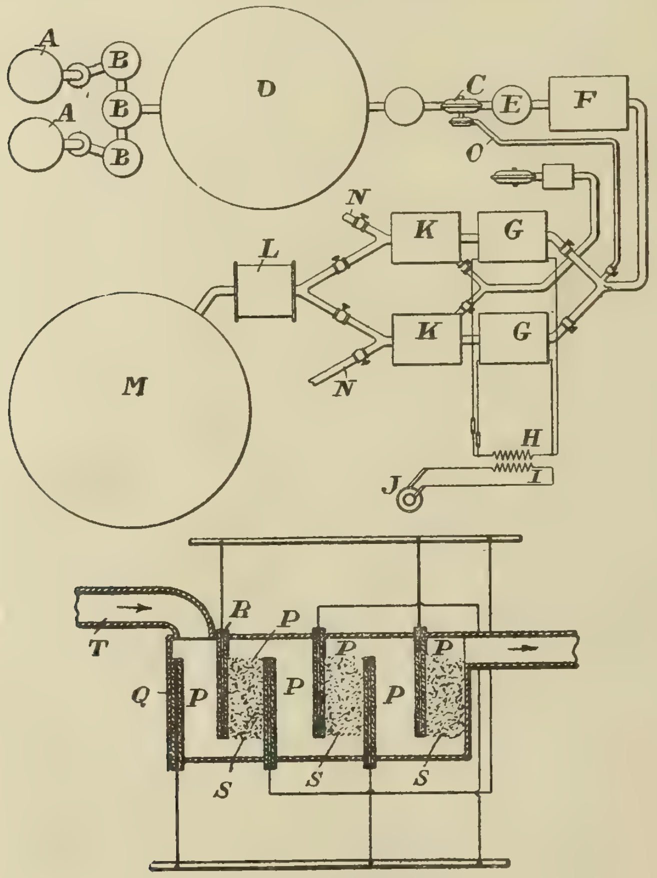
Purification of Gases.

Hall, E. L., of Portland, Oregon, U.S.A.

No. 21,525; Oct. 26, 1914.

This invention, relating to the purification of gases from sulphur contained in various forms, comprises "a process of purifying gases, more especially combustible gases, wherein the gas is caused to travel through a high-tension electric discharge to alter the chemical composition of the contained impurity—as, for example, sulphur compounds—into more easily removable forms, and such altered impurities are thereafter removed from the gas by suitable purifying means."

The patentee claims to have discovered that if gas containing difficultly removable sulphur compounds be subjected to the influence of a high-potential electric discharge in connection with suitable dielectrics, the sulphur compounds are converted into hydrogen sulphide and other compounds of sulphur which can be removed from the gas by any of the usual processes employed for the removal of hydrogen sulphide. He states that, while the process is of "broad application," it is particularly adapted to the manufacture of illuminating gas, in which the removal of sulphur compounds must be effected as completely as possible; and he illustrates the process, as applied to the manufacture of illuminating gas from oil—such as a California or Texas petroleum—of high sulphur content. The process described may be carried out in various forms of apparatus, so long as a high-potential discharge chamber or gas-passage is followed by a suitable purifier. Advantageously, the apparatus is so constructed that the gas is alternately subjected to a high potential discharge and then purified from the resulting hydrogen sulphide—both treatments being repeated a sufficient number of times to give a gas of the desired degree of purity.



Hall's Gas Purification Process.

Apparatus suitable for carrying out the process is shown in a "diagrammatic layout" of a complete plant and a longitudinal section of a special type of combined converter and purifier which may conveniently be employed.

Gas-generators A are connected by dip pipes with washboxes, pipes from which lead to scrubbers B, where tar which has escaped deposition in the washboxes is separated by suitable cooling means. An exhauster C draws gas from the relief holder D, through a scrubber, and forces it through a washer E, all connected together. The gas leaving the washer passes to a purifier F containing hydrated iron oxide (for absorbing the hydrogen sulphide from the gas) and thence to a Y pipe having branches (provided with valves) leading to carbon bisulphide converters G similar in structure. Each converter comprises a chamber containing electrodes of opposite sign having connections to the secondary H of a transformer, to the primary I of which power is supplied from a suitable alternating current generator. Following the converters G are secondary hydrogen sulphide purifiers K, containing iron oxide. From the purifiers the purified gas is discharged through a Y branch and station meter L to the holder M. Valved waste-gas ports N are provided for use in the regeneration of the oxide purifier. The air inlet O, which joins the branch conduit (at a point in advance of its entry) to the CS_2 converters G is supplied by an air-fan directly connected to the exhauster C.

The method of employing the apparatus is that gas generated in the generators passes into the wash-box where the heavier tarry matters are deposited, and the uncondensed portions of the gas pass thence to the scrubber, where they are cooled and where further quantities of tarry and other condensible matters are separated. The cooled gas is then drawn from the relief holder by the exhauster and forced through the succeeding train of washers and purifiers, whereby the gas is freed from hydrogen sulphide. On leaving the train of purifying apparatus it still contains carbon bisulphide and other organic compounds of sulphur which are not removable by ordinary means of purification.

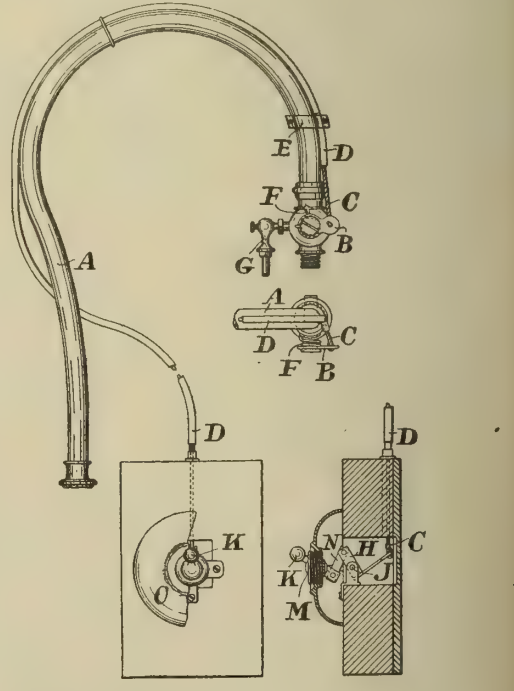
Instead of using secondary purifiers K, the converters and purifiers may be combined as illustrated, where the apparatus consists of a plurality of alternating converting and purifying chambers P. Electrodes Q are of like polarity, while electrodes R are of the opposite polarity. The electrodes are covered with a suitable dielectric material (glass). Each converting chamber is thus provided with opposite walls formed by electrodes of unlike polarity; while the purifying chambers containing iron oxide or the like S have opposite walls formed by electrodes of like popularity. In using the combined converter and purifier, gas enters at T and is subjected alternately to the influence of a high potential discharge and to purification by passing through iron oxide. As shown, the electrodes are in the form of plates arranged like baffles—alternate plates being supported on the bottom of the chamber and extending to near its top; while the other electrodes depend from the top of the chamber to near its bottom. The gas is thus compelled to follow a sinuous course in passing through the apparatus.

Operating Gas-Cocks from a Distance.

Rasch, L., of South Norwood, and Watkinson, F., of Farringdon Road.

No. 3959; March 12, 1915.

This invention relates to devices for operating gas-cocks from a distance by means of a Bowden wire motion or power transmitting means operated by a lever or switch fixed some distance away from the gas-cock—a spring being provided which tends to keep the cock closed and which assists in closing the cock when the switch is moved from the "on" to the "off" position. The switch is mounted on a ball-and-socket joint and is operated by a toggle lever so devised that it will remain in the position in which it is placed until again operated to move the gas-cock.



Rasch and Watkinson's Gas-Cock Operator

A part sectional elevation of a gas-fitting and the switch is shown; also a cross section of the switch and a part plan.

A is a gas supply pipe and fitting provided with a cock B, C is the wire, and D the flexible tube of the Bowden wire mechanism. One end of the wire is attached to the cock and one end of the flexible tube is secured to a band E on the fitting. A spiral spring F tends to keep the cock closed. G is the bye-pass to the pilot light. H is a bent lever pivoted at J, to one end of which is attached the wire C. K is a switch handle mounted on a ball-socket joint M. A link N connects the switch handle to the bent lever. The other end of the tube D is secured to the switch block.

When it is desired to turn on the gas, the lever K is depressed and, operating through the link N, lever H, and wire C, operates the cock B. By lifting the switch into the position shown the wire C is released, and the cock B is returned to its normal (closed) position by the spring.

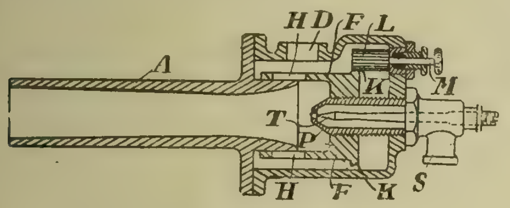
Air-Blast Burners.

Davis, H. N., and Twigg, W. R., of Luton.

No. 4126; March 16, 1915.

This invention is to "provide means whereby a very fine adjustment of the proportion of gas to that of air entering the mixing chamber may be made, and also whereby a complete mixing of the gas and air s ensured."

In the section, taken on the longitudinal axis of the burner, the mixing chamber A is shown of cylindrical form and provided with a circular flange, to which is bolted a casing provided with a gas inlet D. The inner end of the mixing chamber protrudes into the casing, and over it is fitted a cap F, which is capable of being slidden and rotated on the end of the mixing chamber. The cap is provided with longitudinal slots H in its walls, so arranged that, when the cap is slidden owards the inner end of the mixing chamber, communication between he recess and the inside of the casing is cut off. When, however, the cap is retracted, the slots are gradually opened, until communication through the whole area of the slots is established.



Davis and Twigg's Air-Blast Burner.

On the extreme end of the cap (remote from the mixing chamber) a oothed wheel K is maintained in gear with a long pinion L secured to he stud M, which is in turn supported in a suitable stuffing box rranged in the casing. The portion of the stud protruding through he outer end of the casing is fitted with a handle for operating the pinions K and L, and consequently the cap F.

An air-blast nozzle P, disposed concentrically with the cap and mixing hamber, is secured in a tapped hole in the casing. The cap is also rovided with a tapped hole, the threads of which engage with those f the nozzle P, so that the cap is travelled along the nozzle when otated by the gearing. The nozzle is hollow and formed with an rifice in its end nearest the mixing chamber for discharging air into he chamber. The end of the nozzle outside the casing is provided vith means S for connecting it with a supply of air. A needle valve T, aving an enlarged end, screws into the outer end of the nozzle for the urpose of regulating the supply of air.

In operation, gas on being admitted passes through the slots H in he cap F to the mixing chamber A, where it meets, and mixes with, he air being discharged from the nozzle. If the mixture of gas and ir is found to be too poor or too rich, the cap is so operated as to otate and traverse the cap F upon the nozzle P through the agency f the gearing K L. By this means the cap is retracted or advanced, s the case demands, so as to increase or decrease the effective area of he slots, and admit gas to the mixing chamber as required.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Controlled Establishments.

Last Wednesday Mr. S. Roberts asked the Minister of Munitions vhether he intended to seek further powers from Parliament to enable im to take over as controlled establishments undertakings, like electric power stations and other businesses, essential to munition works, ut in which munition work itself is not actually carried on?

In reply, Dr. Addison said the Minister of Munitions hoped to deal ith this question in a Bill which will shortly be laid before Parliament.

Shortage of Nitrate.

Mr. Acland (the Parliamentary Secretary to the Board of Agriulture), in the House on Thursday, said, with regard to the importaon of nitrates for agricultural purposes, that it was likely there would e a very considerable shortage of nitrate of soda unless special steps ere taken. The shortage of a very essential fertilizer would be a erious matter for next year's production. The total amount of nitrates this country, or on its way to it, was only about 30,000 tons, while e ordinary consumption of nitrate of soda for agricultural purposes as estimated to be about 100,000 tons. It was, therefore, necessary make arrangements to secure at any rate some approximation to e normal supply.

A hint of the approaching close of another year is to hand, in the ape of a particularly effective calendar for 1916, which has been preared by the British Commercial Gas Association. The calendar does ot advertise the Association; but it gently draws one's thoughts wards gas, by means of a well-executed picture and some sound marks printed upon the date slips.

LEGAL INTELLIGENCE.

A METROPOLITAN RATING APPEAL.

A point of considerable interest to gas, electrical supply, and similar undertakings in the Metropolis arose in the appeal of the Brompton and Kensington Electricity Supply Company, Limited, which was heard at the London Quarter Sessions last Tuesday. The question discussed was whether the Kensington Assessment Committee were justified in increasing the rateable value placed upon the Company's works and mains by £1000 in view of certain structural alterations at the works at West Brompton, and also of an increase in the net profits of the concern in the years 1912 and 1913, as compared with the years 1909 and 1910, which were considered at the time of the last quinquennial revaluation in 1910.

Mr. Ryde, K.C., appeared for the appellants; Mr. Clavell Salter, K.C., M.P., and Mr. Whiteley, for the Kensington Assessment Committee.

Expert evidence for the appellants was given by Mr. H. M. Carpenter, and Mr. Spencer Hawes. Evidence was also given by Mr. Thomas J. Owens, the Company's Secretary. The respondents' witnesses were Mr. W. H. Eve, Mr. A. L. Ryde, and Mr. W. Chambers Leete.

After a long hearing, it was decided by the Court to reduce the rateable value by £400—leaving a net increase of £600 on the quinquennial assessment settled in 1910; and they awarded a proportion of their costs to the Assessment Committee.

The Chairman stated that the Court were of opinion that an increase of value had taken place which justified the inclusion of the property in the provisional and supplemental lists at an enhanced rateable value, but not to the extent claimed by the Assessment Committee.

A Strike and a Gas Account.

Before the Neath Magistrates last week, there was a sequel to the recent strike at the Corporation Gas-Works; Herbert Short, of the Neath and District Laundry, being summoned for non-payment of his Company's account. On behalf of the defendant, it was pointed out that the whole of the plant was worked by gas power, and that during the strike the laundry was closed-down for eight days. The net loss to the defendant was £15, and he also lost a number of customers. Defendant offered to discharge the liability by payment of £1 per month. The Bench, however, made an order for the payment of £5 in fourteen days; the rest to be paid in instalments of 5s. a week.

An Electrical Power Station Nuisance.

In the Chancery Division of the High Court of Justice last Thursday, Mr. Justice Neville had before him an action—*Dexter v. Aldershot Urban District Council*—in which the plaintiff sought to restrain defendants from working an electric plant and condensing tower in such a manner as to constitute a nuisance. It was stated that the Council had erected close to plaintiff's property buildings containing engines and plant to supply electricity to Aldershot, as well as a condensing water-tower over 50 feet high. The nuisance complained of was caused by vibration and noise from the machinery, and the emission of large quantities of steam and vapour from the condenser. The Council admitted that a Diesel engine had from time to time caused some vibration, though not sufficient to cause nuisance or injury to the plaintiff; and this vibration, they said, had been diminished since the engine had got into perfect running order. They offered to use the engine to only a limited extent until means should have been found of entirely preventing the vibration, and paid into Court, with a denial of liability, the sum of £5. If these terms were accepted, they would pay the plaintiff's costs. They denied that steam or vapour could to any appreciable extent enter plaintiff's house. In the end, his Lordship granted the injunction asked for against noise and vibration, but stayed its operation until three months after the declaration of peace.

Too Much Light from a Gas-Works.

Mr. Charles Snelling, the Manager of the Thetford Gas-Works, was charged before the Magistrates last week with failing to reduce the intensity of the light in the engine-house and retort-house on Oct. 13. Captain North said about 8 o'clock that day his attention was drawn to the gas-works. He saw a strong ray of light shining upwards, and ascertained that it was from the furnaces. Several people in the road complained of the light. Defendant said there were two motor-cars in the yard; and the light from the lamps was thrown on to his house and the retort-house. Horace Hawes, a special constable, said he was on duty near the works, when Captain North made a communication to him. He went to the works, and found a light coming from the retort-house. There was also a light from the engine-house. Defendant, on oath, stated that when Captain North called he told the officer there was no light, and invited him into the yard. There was no light from the retort-house or engine-house until he opened the engine-house door. He had done all he possibly could to assist the police. The Mayor said the Bench, having gone fully into the case, had come to the conclusion that an offence had been committed. Defendant would be fined 5s., including costs.

A second edition has been published by the Great Central Railway Company—the first edition, issued about a year ago, having been exhausted within a few months—of the "Magnet of Commerce." A great many useful statistics, &c., are contained in the book, the object of which is to periodically give interesting and useful information to colliery owners and managers, exporters, and business firms.

MISCELLANEOUS NEWS.

PARLIAMENTARY BILLS FOR THE SESSION OF 1916.

NEWCASTLE GAS COMPANY'S POWERS.

Notice is given by the Newcastle-upon-Tyne and Gateshead Gas Company of their intention to apply for an Act in the next session of Parliament.

They desire authority to extend the limits within which they may supply gas, as defined by their Acts of 1864, 1867, and 1901, so as to include a number of fresh parishes, &c., in Northumberland and Durham. The substitution of a calorific value test for the illuminating power standard is sought, as well as further powers with reference to the working-up, conversion, and utilization of residual products arising from the manufacture of gas, and authority to purchase such residual products from other gas undertakers, or from any other company, authority, body, or person, and to utilize, work-up, or convert the same, and to manufacture other products therefrom, and sell or otherwise dispose of the products. There are provisions relating to conditions of gas supply, including the variation of the price according to the purpose for which the gas is to be used. Further borrowing powers are desired.

PLYMOUTH AND STONEHOUSE GAS BILL.

Publication was made in the "Western Morning News" on Saturday of the intention of the Plymouth and Stonehouse Gas Company to apply for a Bill in the 1916 session of Parliament.

The Bill is to authorize and provide for the establishment, maintenance, and management by the Company of the business of distillation of tar and the utilization of tar and other products directly or indirectly arising in, or resutlng from, the manufacture or production of gas or the distillation of tar, and to authorize the Company to acquire, establish, carry on, and maintain works at which tar may be distilled, and at which tar and other products directly or indirectly arising in, or resulting from, the manufacture or production of gas or the distillation of tar by the Company or by other companies, local authorities, bodies, or persons may be utilized or treated, and to authorize the Company to purchase from any other company, local authority, body, or person any such products (other than tar), and to enter into and carry into effect agreements with reference to the utilization, treatment, and disposal there of products obtained from the distillation of tar, and to enter into and carry into effect agreements with reference to the matters aforesaid or any of them. It is also to enable the Company, and any other company, local authority, body, or person supplying gas or producing tar within the counties of Devon and Cornwall to enter into agreements with reference to the purchase by the Company of tar or other products as aforesaid, and for the carrying on of such undertaking or business upon a co-operative principle, either by the Company alone or by the Company and any such other company, &c. The Company seek power to enter into, and carry into effect, contracts and agreements with any other such company, body, or person. They desire further powers with reference to the working-up, conversion, and utilization of tar and of residual products arising directly or indirectly from the manufacture of gas or the distillation of tar, and of similar products arising from other manufactures or processes, and to manufacture other products therefrom and to sell or otherwise dispose of such products. For these purposes, they wish to acquire by agreement the lands, tar distillery, plant, and business carried on by the Executors of the late Thomas Henry Harvey.

Other provisions in the Bill relate to the substitution of the calorific value for the illuminating power test, supply to premises having a separate supply of gas or electricity, power to refuse or supply in certain cases, and the raising of additional capital.

UXBRIDGE AND ETON GAS SUPPLY.

The Uxbridge Gas Company are desirous of acquiring the undertaking of the Eton Gas Company; and to carry the scheme into effect they give notice of their intention to promote a Bill. There are provisions for the transfer to the Uxbridge Gas Company of all or any of the officers and servants of the Eton Company, and the payment of compensation and gratuities to those removed from office, as well as to the Directors. There are clauses relating to conditions of gas supply—one of them referring to the variation of the price of gas according to the purpose for which it is supplied—and for the appointment of a managing-director. Additional capital powers are asked for, and the removal of all statutory limits upon the rate of interest to be paid by the Company on mortgages or debenture stock.

COLCHESTER AND THE CALORIFIC STANDARD.

A Bill is being promoted by the Colchester Gas Company to enable them to manufacture and store gas and treat residual products on certain lands; and to alter, extend, or limit and define their powers with regard to the purchase of residual products used in, or arising from, the manufacture of gas and of materials required for working-up and converting any such residual products. An extension of the limits within which the Company are authorized to supply gas is asked for, as well as the substitution of a standard calorific power for the prescribed illuminating power. There are a number of financial clauses, which include the raising of further capital, the adoption of the sliding-scale, the creation of a special purposes and a reserve fund, the adoption of co-partnership. There are also various provisions with regard to conditions and obligations in the matter of the supplying of gas.

FERNDALE GAS COMPANY'S REQUIREMENTS.

The Ferndale Gas Company, Limited, intend to apply to Parliament for leave to bring in a Bill to amend their Order of 1883, to confer additional capital and borrowing powers, to make provision for reserve, depreciation, renewal, special purposes, and other funds, and to prescribe the quality, calorific power, or illuminating power and pressure of the gas supplied. The Bill is also to make provision with respect to the supply by the Company of gas to persons having a separate supply of gas or electricity, and as to the terms and conditions of such supply, and the minimum annual charges to be made by the Company in respect thereof and in respect of other supplies, and if deemed expedient to relieve the Company from the obligation to supply such person and premises. Other clauses relate to differential prices, and various points affecting the consumers.

GAS SUPPLY OF PARIS.

Results in the First Year of the War.

In a recent issue of the "Journal" the principal results of the working of the Paris Gas Company in the twelve months ended Dec. 31, 1914, were given. We now reproduce some additional particulars from the report of the Directors of the Company for the above-named period, which was presented at the last annual meeting.

General Statistics.

The period of the report embraced five months of hostilities against the Teutonic powers; and the Directors naturally sought to convey the idea of what the position of the Company would have been had events pursued their normal course. They therefore presented figures for the first six months of 1914 in comparison with those of the corresponding period of 1913. Those relating to the later period show an advance in every instance. The total quantity of gas sent out from the works was 246,170,720 cubic metres (equivalent to about 8694 million cubic feet)—an advance of 3,992,550 cubic metres, or nearly 141 million cubic feet, on the output for the first half of 1913. The day consumption amounted to 118,278,910 cubic metres (4177 million cubic feet), an advance of 6,409,200 cubic metres, or just over 226¼ million cubic feet. The quantity of gas sold was 232,680,940 cubic metres, or 8217½ million cubic feet—an advance of 5,121,460 cubic metres, or 180¾ million cubic feet, representing an increase of 2·2 per cent. The revenue from the sale of gas was 45,508,109 frs. (£1,820,324), compared with 44,540,109 frs. (£1,781,604), an advance also of 2·2 per cent. At the end of June 30, 1914, the number of consumers on the books was 719,899—an increase of 20,182 on the figure for June 30, 1913, which latter was 18,791 in excess of that on the corresponding date in 1912. The report does not distinguish this year between the Company's two classes of customers, ordinary and free-fitting.

In the public lighting of the city the number of lamps in use on June 30, 1914, was 63,314, as compared with 61,622 at the end of the previous December. Of these, 1231 were open-flame burners and 62,083 incandescent—a decrease of 2 in the former and an increase of 1694 in the latter.

The report records a further considerable extension of high-pressure lighting. The number of gas centres in use on June 30, 1914, was 1565, representing over 3¼ million candle power, as compared with 1221 at the end of 1913, of a total illuminating power of 2,571,000 candles. It is interesting to note that the use of high-pressure gas has been more than doubled within a period of eighteen months. During the six months under review this system of public lighting has been installed in leading thoroughfares such as Boulevard Haussmann, Avenue des Champs-Elysées, and the Place de la Concorde. Following the outbreak of hostilities, reductions were made in the street lighting to an extent of more than 50 per cent., in conformity with military regulations by which a still lower standard of illumination for the streets has been directed.

Further development has taken place in the installation of rising pipes for tenements. The number on June 30, 1914 was 59,080, as compared with 58,428 six months previously; the former figure representing 589,371 consumers supplied with gas in this way. The number connected during the first half of 1914 was 7484, as compared with 6973 in the corresponding period of 1913. Further extensions in this direction have been almost completely suspended during the war.

The length of the Company's mains at Midsummer 1914 was 2076 kilometres (1289 miles), an addition of 36 kilometres (22⅓ miles) in the six months. The total includes an addition of 335 kilometres (208 miles) to the system within the period of the Company's concession.

Financial Position.

In the financial section of the report the results of working during the full year 1914 are stated. The revenue from the sale of gas was 77,030,112 frs.; making, with the returns from residuals, meters, and fittings, a total of 98,733,343 frs. (£3,949,334). The expenses for the year amounted to 94,556,211 frs. (£3,782,248), of which 1,586,842 frs. was the remuneration to the Company. There was thus a balance amounting to 4,177,132 frs. (£165,085), compared with 23,460,816 frs. (£938,433) in 1912 and 21,454,266 frs. (£858,170) in 1913. Commenting upon the great discrepancy between these figures, the report enters into an estimate of the results which would have been obtained had conditions not been grossly disturbed by the war. After allowing for the increased cost of loan and additional pension charges, and assuming all other factors equal to those of the previous year, the balance to have accrued to the Municipality is estimated to be 18,750,000 frs., or £750,000. The sales of gas over the whole of 1914 were about 14 per cent. below those of 1913, with the result that overhead charges, such as interest, pensions, compensation, &c., pressed proportionately heavily. Moreover, servants of the Company called to the army have been treated as municipal employees, and have received their full salaries. This item, which realized no work whatever, absorbed 6,100,000 frs. (£244,000) for the last five months of the year. Heavy costs had also to be borne, as previously reported in these pages, in the purchase of coal and in freightage.* Up to June 30, 1914, deliveries of coke showed a net increase of 568,211 frs., as compared with 1913. The sales of sulphate of ammonia were likewise up by about 3000 tonnes; while pitch and heavy oils were at better prices.

In the service to consumers the Company are pleased to report that, n spite of dislocation caused by the war, they were able to maintain atisfactory deliveries of coke and residuals in the face of reduced staff, eplenished stocks, and lessened transport facilities. Considerable deiveries of coke were made to the military authorities, and the manuacture of benzol, crude phenols, and other products specially underaken for the Ministry of Munitions. Progress has been continuously nade in extending the use of gas fuel in bakeries, laundries, and for ther industrial purposes, as well as in the heating of single rooms and y central systems; but active propaganda work in these directions as necessarily had to be suspended until a more favourable time.

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* See "Journal," Oct. 12, p. 81.

FRANKFORT GAS COMPANY.

Report for the Year 1914-15.

The report of the Frankfort Gas Company for the financial year 914-15 states that, on the outbreak of war, there was a great reducion in business, owing to restricted public lighting and the economy xercised by all classes. But later this reduction was nearly countercted through the scarcity of petroleum. Nevertheless, the consumpion of gas showed a falling off of 5·69 per cent. in comparison with that or the preceding twelve months. The consumption in the first five nonths of the current working year points, however, to a return to the ormal conditions of increasing output.

The demand for coke fell off in the latter half of 1914 to such an exent that the storage yard became overfull, and a considerable reducon in price had to be made in order to clear it. Since the beginning f 1915, however, there had been a lively demand for coke, and by the nd of the financial year the yard had been quite emptied at higher rices. Sulphate of ammonia experienced a further considerable fall n value, owing to the production of synthetic ammonia; but here, gain, better prices were now being realized. Tar was in good demand t rising prices.

About £7700 was applied to the benevolent fund and war allowances. he total receipts were about £14,295 less than in the previous year; ut the expenses were reduced by about £5870, and smaller payments ere made to the Corporation of Frankfort-on-the-Maine, and fo the eserve fund. The dividend at the customary rate of 10 per cent. is, herefore, being paid; and the carry-forward is higher by £950 than n the previous year.

TORONTO CONSUMERS' GAS COMPANY.

The Sixty-Seventh Annual General Meeting of the Company was eld in Toronto on the 25th ult.—Mr. A. W. AUSTIN (the President) n the chair.

In the report which was submitted, the Directors said that, in view of he many adverse conditions which had surrounded all classes of public tility undertakings, they believed, although there had been a slight ecrease (1·2 per cent.) in the revenue from gas sales, the result of the ear's operations would be satisfactory to the shareholders. Owing to he retarded activity in the development of suburban districts, and the educed number of new buildings being erected, there had necessarily een a smaller mileage of street-main extensions needed than in some ormer years. However, 15 miles of mains had been laid during the ear, and 3124 new services installed. Operating costs had increased; tems of additional expenditure being generally of an uncontrollable lass—principally, either directly or indirectly, war taxes. The imports f raw materials used by the Company had been made subject to a special ariff imposed by the Dominion Covernment, over and above the normal ustoms Duty charges. There had also been an increase of nearly 9 per cent. in municipal taxes. Having these important facts in mind, hareholders would realize the necessity for every department of the ompany being operated at a maximum of efficiency, and a minimum f expense. In these respects, the officers of the Company had eneavoured faithfully to carry out the policy of the Directors, with the esult that the revenue derived from the sale of the Company's proucts had been sufficient to cover operating expenses, the actual cost f repairs and renewals, interest charges, and dividends. More than oo of the Company's employees had enlisted for active military serice; and the Directors had considered it their duty to grant liberal nancial assistance to the wives and families, making it unnecessary for ny of them to become a charge on any public fund. The shareholders ere asked to confirm this action, and also to express their approval of subscription of $2000 made by the Directors on behalf of the Comany to the Belgian Relief Fund. Among the employees who had not nlisted for active service, special subscriptions for patriotic purposes ad realized the sum of $3300.

The following statement compared items of the past with the preeding year.

	Meters.		Gas Sales.
Year ending Sept. 30, 1915	102,548		$2,423,921·37
” ” ” 1914	99,648		$2,453,417·64
	Increase 2,900	Decrease	$29,496·27

The PRESIDENT remarked that, notwithstanding the great depression n business generally, it was most gratifying to find the output of gas ad been about the same as last year. This was in face of the fact that ome 6500 buildings had been closed throughout the city. There had een a great increase in the use of gas for cooking and manufacturing urposes. The number of meters in use had also increased over 2900, naking the present number 102,548—the largest in the history of the ompany. Considering that the war had seriously affected the majoity of other stocks, the fact that the price of their shares had been naintained should afford general satisfaction to the shareholders. Vhile, on account of the war and depression arising therefrom, the irectors had endeavoured to curtail expenses wherever possible, they ad made certain changes in the carbonizing and generating plants; nd by means of these alterations, and through the ingenuity of some f the mechanical staff, they were able to manufacture more gas than before, with less outlay. They were proud that such a large percentage of the employees had enlisted, and were keeping their places open for them on their return. The Board regretted, however, that some of the very best had fallen on the field of honour; and the bereaved had the sympathy of all the shareholders. It was intended to establish a Roll of Honour for those who had answered their country's call in the War of Nations. As on previous occasions, he could only reiterate what he had said before of the Directors' appreciation of the faithful services of the officers and employees. It was not to be doubted that, under such able and progressive management, the Company would continue to maintain the high prestige it had enjoyed for the past sixty-seven years.

The VICE-PRESIDENT (Mr. Wellington Francis, K.C.) seconded the adoption of the report; pointing out that in the whole of the long period of the Company's existence, there had never once been a failure in the supply of gas. With two exceptions, the Company made the lowest charge for gas in the Dominion; while there was no better plant, and few to equal that of the Company. In view of the abnormal conditions, it must be gratifying to the shareholders to know that the Company had been able to maintain the usual rate of dividend.

The report was adopted.

WOMEN FOR CLERICAL WORK.

Replacing Enlisted Men.

At the urgent request of the Home Office, Mr. John Young, the President of the Institution of Gas Engineers, has addressed to the members a circular-letter, directing special attention to arrangements which are being made to assist employers in replacing clerks withdrawn for service with the military forces.

He pointed out that a conference was recently held at the Home Office, at which it was shown that in the near future, as men are called up, there will be a great and increasing demand in all commercial centres for clerical labour, which it may be difficult to meet fully except by the introduction of women clerks, as well as of young boys and of men who have been rejected as unfit for military service or have been invalided out of the army. The Committee of the Home Office having the matter in hand are approaching the local authorities in all important towns, and inviting them to at once start schemes for organizing a supply of clerical workers, and for fitting them, as far as can be done in the time available by emergency classes, to supply the places of the men who have gone. The local authorities will be invited to co-operate closely with the employers in their respective areas, and among other things:

(1) To prepare as careful an estimate as possible of the existing and contingent demands for clerical labour.

(2) To devise and initiate suitable courses of instruction.

(3) To take steps to attract a supply of women of sufficient education, and to keep a register of those who pass through the emergency classes.

Lord Derby, in his address at the conference, laid special stress on the desirability of giving a preference in employment to the women relatives of enlisted men.

In the interests of recruiting, Mr. Young adds, it is highly important that the places of enlisted men should be kept open for them. This is an honourable rule, and is believed to be a practically universal one in the branches of employment under consideration. No less desirable is it that the employment of substitutes for enlisted men should be known to be, and declared to be, temporary and for the period of the war only.

Members are asked, if it should be possible for them to assist the important work of recruiting in the manner suggested, to communicate as soon as possible with their local authority, stating requirements.

Miners' Wages Increased.—The Coal Conciliation Board for England and North Wales have agreed to a further advance of 5 per cent. in wages, which is to be paid from the second pay day in December. The advance is to be on the new wage standard, apart from the war bonus which was given by Lord Coleridge.

The Lighting of Kingstown.—In a letter to the Kingstown Urban Council, Mr. Grey, the Secretary of the Alliance and Dublin Consumers' Gas Company, regretted that the Council had found it necessary to complain of the quality of gas supplied for the public lighting of the township [*ante*, p. 330]. The light, he said, was maintained at a standard in excess of that prescribed by Parliament. He drew attention to a letter written in May last directing the notice of the Council to the fact that the lamps were not of modern type or storm-proof, and that, unless they were overhauled, they would not give complete satisfaction. It was not until early in October that the recommendations on the subject were adopted. The Council marked the letter "Read and noted."

Lighting of Torquay Streets.—A considerable amount of feeling has been aroused at Torquay by the decision of the Town Council further to reduce the lighting of the streets and roads in the town. Since the beginning of the war lamps visible from the sea have not been lit; but in parts of the town where they do not shine seaward the lighting has been as usual. In all, 1033 lamps have been lighted and 300 unlighted. Now it is proposed to add 700 to the number unlighted, not because of any military necessity, but in order to economize. It is contended that the effect of leaving the town in darkness, except at certain dangerous points, will be to save £3000 in the rates. One of the local newspapers warns the ratepayers not to expect that this saving will be actually realized, as money saved in one way by the municipality is very likely to be spent in another direction; while numerous residents protest strongly against the folly of imposing on Torquay voluntarily the disabilities against which East Coast health resorts have had to contend during the war. The cost of public lighting in Torquay last year was £4346.

USE OF TAR UPON HIGHWAYS.

The urgent need there is that local authorities should absolutely prevent the use of crude tar upon roads and footpaths so long as the war lasts, forms the subject of communications last week addressed to county councils and urban anthorities and to rural district councils, by Mr. H. P. Maybury, the Engineer to the Road Board. The letter to county councils and urban authorities is in the following terms.

> I am directed by the Road Board to refer you to their circular letter of March last, wherein local authorities were asked to use only refined or distilled tar in connection with their road maintenance and improvement works, in order that there might be no waste of those tar products required in the manufacture of explosives, and which are obtained by the distillation of crude tar.
>
> The Board much appreciate the readiness manifested by highway authorities generally to comply with their request, and are satisfied that, as a result, a largely reduced quantity of crude tar has been used upon the roads in the past season, although they are advised that its use still continues in certain districts. This is no doubt partially due to the fact that the request was made at a time when road-tarring operations had either commenced or contracts had been entered into by which quantities of crude tar had been purchased, and partly to the fact that the importance of the request was insufficiently realized.
>
> The continually increasing demands for coal-tar products for the manufacture of explosives make it essential that no possible source of supply of the crude material shall be overlooked; and the Board are again requested by the Ministry of Munitions to urge highway authorities to see that arrangements are now promptly made which shall absolutely prevent the use of crude tar upon highways and footways during the continuance of the war, whether for spraying, painting, grouting, or the manufacture of tarred macadam—taking care that, if the latter material be supplied by the contractors, only refined tar shall be used in its preparation.
>
> The Board are confident that, when the great national importance of this matter is understood by highway authorities, they will gladly co-operate with the Ministry of Munitions, and will (by their instructions) ensure that all tar, or tar preparations, to be used in, or upon, road works shall have first been freed from the whole of the benzol, toluol, and phenol contents.

The letter to the rural district councils is to the same effect, but includes the subjoined paragraphs.

> Refined tar can now be obtained in unlimited quantities, at reasonable prices, at so many gas-works and distilleries, that the Board are confident that, once the importance of the matter is realized by local authorities, they will gladly co-operate with the Government Departments, and issue such instructions as shall effectually prevent the use of all tar, and tar preparations, from which these valuable and essential products have not been extracted.
>
> As you doubtless know, the Road Board have issued specifications relating to tar to be used both for spraying, painting, and grouting and the manufacture of tarred macadam; and, if future purchases are effected in accordance therewith, your authority will have the satisfaction of knowing that they are carrying out their road-tarring operations with material best suited for the purpose, and will, at the same time, have succeeded in conserving for national purposes the products which are now so urgently required.

In both cases the communications are accompanied by a list of questions, to which the authorities are asked to furnish prompt replies. The information desired is with regard to the quantity of refined and crude tar used for surface dressing in the six months ended Sept. 30, and the area covered, as well as the quantity employed—refined tar, crude tar, or proprietary material—for material coated or grouted during the year.

GAS-WORKS RESULTS AT WIGAN.

In the course of his report to the Gas Committee on the working of the Wigan Corporation Gas Department for the financial year ended March 31 last, Mr. Fred Betley (the Engineer and Manager) stated that the period had been a disappointing one; the first three quarters being marked by a further fall in the value of residuals. There had also been a reduction in the output of gas during the latter half of the year—largely accounted for by the effects of the war, and partly due to the loss of one large consumer and the substitution of the incandescent burner for the flat-flame on the premises of the Corporation's biggest customer. There was an increase in consumption for cooking and heating purposes of over 9 million cubic feet. In spite of increases in wages and holidays, the expenditure was less. Coal and oil prices made the outlook for the present year anything but rosy. At the beginning of the year there were on the register 13,129 consumers by ordinary meter, and 11,463 users of prepayment meters. The figures at the close of the year were 13,191 and 11,962. The number of gas-cookers in use increased from 2197 to 2345. There were 40,322 tons of coal carbonized, and 112,515 gallons of gas oil used, during the year; the make of gas being 509,368,000 cubic feet. As compared with the previous year, the coal carbonized was 97 tons less; while the make of gas decreased by 5,251,000 feet.

The working resulted in a gross profit of £25,510, against £28,238 for 1913-14; the net profits being £1104 and £4108 respectively. The average profit for the past thirty years is £24,505 gross, or 11·65 per cent. on the capital invested, and £9442 net, including the value of the

To Undertakings serving Military Areas.

SINCE the commencement of the War, we have supplied our large Gas Cooking Specialities to the majority of the principal Military Hospitals (including the splendidly equipped King George Hospital, Stamford Street, S.E., with some 1500 beds), as well as to several large Munition Centres.

Send us your Inquiries for Double and Treble Ovens, Hot Closets, Boiling Tables, Central Ranges, Tea Urns, Boiling Coppers, Steam Chests, Large Roasters, Vegetable Steamers, Carving Tables, &c., &c.

The Davis Gas Stove Co., Ltd., The Gas Exhibition Salons, **60, Oxford St., London, W.**

;as supplied free for public lighting within the borough, which for ast year represented the sum of some £5420 net. This, added to the .mount (£1104) shown under the head of net profit for the year, repreented £6525 as the total net profit. The net cost of coal and equivaent (deducting the revenue from residuals) was 4s. 1¾d. last year, and s. 2¾d. in 1914; the average for the thirty years being 2s. 6d. per ton. 'he gas consumed for all purposes in the past twelve months showed decrease on the preceding year of 6,236,200 cubic feet (equal to 1·29 er cent.). The private consumption and that for public lighting were oth less; while the quantity used for cooking, heating, and motive ower increased by 5,877,300 cubic feet, or 7·25 per cent. The make f gas per ton of coal carbonized was 11,361 cubic feet.

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NATURAL GAS IN THE UNITED STATES.

Production in 1914.

The "United States Geological Survey Press Bulletin," No. 232, r September last, gave some statistics, compiled under the supersion of Mr. J. D. Northrop, of the United States Geological Survey, iowing that the quantity of natural gas commercially utilized in the nited States last year exceeded that so utilized in any previous year the history of the natural gas industry. The quantity produced, hich amounted to approximately 591,866 million cubic feet, valued $94,115,524, constituted a new record of production, exceeding by arly 10,000 millions, almost 2 per cent., the former record, establshed in 1913.

Increases in output in 1914 over 1913 were credited to New York, hio, Oklahoma, Texas, Louisiana, Alabama, Iowa, and California—e last-named State alone recording a gain of nearly 7000 million et. Other gas-producing States recorded declines in output, the eatest of which (that of Pennsylvania) amounted to slightly more an 10,000 millions.

The increases in gas production (it is stated) may be attributed to rious causes—in New York, to the increased drilling activity stimuted by the advancing petroleum market in 1913 and the early part of 14; in Ohio, to local extensions of the productive fields of the gaslt in the central part of the State, and to the development of an imrtant gas-pool in the vicinity of Cleveland, Cuyahoga County; in klahoma, to the development of gas reserves in the Cushing field, eek County, and the Healdton field, Carter County, as well as to a cided expansion of the local casinghead gasoline industry; in Texas, a greater utilization of the gas supplies available in the Petrolia d Mexia fields; in Louisiana, to the greaetr development of the gas serves in Caddo and De Soto parishes; and in California, to increased mands for domestic consumption in Los Angeles and adjacent towns the southern part of the State, as well as for industrial consumption the casinghead gasoline industry.

NATIONAL FUEL ECONOMY.

Dealing with the question of the "National Importance of Fuel Economy," at a meeting held at Stoke-upon-Trent under the auspices of the English Ceramic Society and the North Staffordshire Institute of Mining Engineers, Professor W. A. Bone, F.R.S., remarked that it was tolerably certain that, with a system of efficient supervision of fuel consumption, we should be able to save many millions of pounds on our coal bill, and with improved appliances still more a saving which would in the long run redeem a considerable amount of the War Loan, which was being more easily raised than it would be repaid. It had been estimated that America (North America largely) possessed 69 per cent. of the world's total coal resources; so that there was no doubt where, in the far-distant future, the world's chief industries would be located. As regarded this country, we were exporting a larger and larger proportion of our total output; and the question would come up for discussion, and perhaps legislation, as to whether we should reimpose the coal export duties.

Our home consumption of coal was estimated in 1903 to be 167 million tons. Mines and factories accounted for 71 million tons, or 43 per cent. of the total home consumption. Out of these 71 million tons, 52 millions were used in power raising. This averaged 5 lbs. of coal per horse-power-hour. By using the best type of modern boiler and turbines, this consumption need not have exceeded 2 lbs. per horse-power-hour; and with gas-producers and gas-engines, it could have been reduced to 1 lb. If the iron and steel industries of the country were organized properly, bye-product ovens, blast-furnaces, and steel-works being brought together on one site, instead of 30 million tons of coal being used to obtain the present output, not more than 15 to 20 million tons need be employed.

Then there was the question of the carbonization of coal. Of the 189 million tons of coal consumed in the United Kingdom in 1913, 40 million tons were carbonized as follows: Gas-works, 20 million tons; bye-product plants, 13·5 million tons; and beehive ovens, 6·5 million tons. Supposing we coked the whole of our metallurgical coke by means of bye-product ovens, then there would be a very considerable saving. He would calculate very roughly the profits we were now losing because we were still carbonizing 6½ million tons in the wasteful beehive ovens. He estimated that the profit on the ammonium sulphate would be about two-thirds of a million pounds sterling. The profit on the benzol would be another two-thirds of a million. The profit on the tar was rather difficult to estimate; and then there would be the profit on the surplus gas, which was a very valuable fuel in the industry. With regard to the latter, if it was taken at 3s. per 1000 cubic feet, we should realize another quarter of a million. If the fact were also included that a larger yield of coke was obtainable with the bye-product plant, he reckoned that the realizable profits that were passing into the air because of the 6½ million tons carbonized in beehive ovens was not less than £2,000,000 per annum. The disap-

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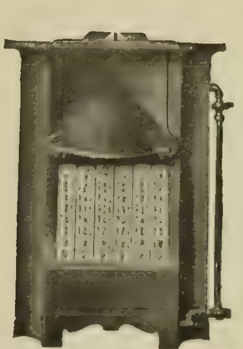
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pearance of beehive ovens was only a matter of years; but the question should be considered as to whether the public interest would justify the Government in fixing a time-limit during which the beehive ovens could remain in operation.

The domestic consumption (20 per cent. of the total home consumption) was the most difficult problem to tackle. He predicted that gas-fires would come more into use; but unless we got down to very much lower than the present price of gas, they would be restricted largely to rooms which were only occasionally occupied. For rooms which were being used every day, he thought they would have to keep some form of solid-fuel fire; and he ventured to think the solution of this problem lay in the preparation of semi-coke fuel—a subject which was being taken up in many quarters, and which he hoped in the public interest would eventuate in a successful issue.

The meeting passed a resolution in favour of the question of fuel economy being taken up on a national basis.

◆

SULPHATE OF AMMONIA AS A MANURE FOR CORN.

Mr. A. W. Oldershaw, B.Sc., Agricultural Organizer for East Suffolk, has sent to the "East Anglian Times" the following remarks on the subject of sulphate of ammonia.

As noted in your columns a few days ago, the President of the Board of Agriculture has come to an agreement with manufacturers of sulphate of ammonia in Great Britain to reserve a definite proportion of their make in November and December for farmers' use [*ante*, p. 324]. As far as the writer's experience goes, sulphate of ammonia is not very widely used in Suffolk—farmers generally preferring nitrate of soda as a top dressing. It must be remembered, however, that sulphate of ammonia is produced at home, whereas nitrate of soda is imported—a point of importance in these times of war. Sulphate of ammonia should practically always be used in conjunction with a phosphatic manure. Thus, for wheat, a dressing of 4 cwt. of basic slag or 3 cwt. of superphosphate may be applied before sowing the wheat, followed by (say) ¾ cwt. to 1 cwt. of sulphate of ammonia later. For spring oats or barley excellent results will usually be obtained by mixing ¾ cwt. of sulphate of ammonia with 3 cwt. of superphosphate, and applying the mixture to an acre, before sowing the crop. Sulphate of ammonia is richer in nitrogen than nitrate of soda, hence rather less is required per acre. It is also somewhat slower in its action, as the nitrogen present has to be turned into nitrates before being utilized by the plant.

◆

The "American Gaslight Journal" reports the acquisition by the New York Consolidated Gas Company of the old edifice of the Central Presbyterian Church, on West Fifty-Seventh Street, so as to remodel it for a divisional office and display room.

COAL TAR AND ITS PRODUCTS.

The correspondence on this subject that has been reproduced in our columns from the "Iron and Coal Trades Review" [*ante*, pp. 150, 211, 278, 333] was continued in Saturday's number of our contemporary by a letter from Messrs. Hird, Chambers, and Hammond, of Huddersfield, in which they wrote:

We are pleased to note that our little explanation has served the purpose of reducing the number of objections which "Distillation" originally made against our article, "Coal Tar and Its Products." He still holds the opinion that the article was misleading and exaggerated. If "Distillation" will peruse the original statement, he will find that the results given were obtained on average gas tar. The results were also approximate. However, as "Distillation" appears to have in mind more particularly coke-oven tar, we propose to give him some details which will demonstrate that the position is not so bad as he asserts.

With reference to the production of benzol, "Distillation" has no foundation whatever for assuming that our figures refer to finished products. We stated very plainly that the products of rectification were "90 per cent. benzol, solvent naphtha, and crude toluol." Surely "Distillation" in this matter is himself somewhat misleading.

As to the cost of rectification, your correspondent's several years' experience does not in any way affect our statement. We were rectifying benzols twenty years ago; and we, too, speak from experience.

With regard to carbolic acid, if "Distillation" is dealing with a North-Country coke-oven tar, our own experience on a plant treating the oils from 30 tons of tar per day has shown that 6 gallons of tar acids, containing 3 gallons carbolic and 3 gallons cresylic acid, cannot be obtained; and it does not affect our original article in the least to concede this fact.

However, as "Distillation" will insist on quoting current prices, let us look at the matter entirely from his point of view—basing our calculations so far as possible on the quantities of tar acids which he gives. He admits that he can get 1½ gallons of saleable carbolic acid; and presumably he will also obtain from the oils not less than 3 gallons of cresylic acid. To-day crude carbolic is selling at 3s. per gallon, and cresylic at 2s. 6d. per gallon. The total values of the tar acids from coke-oven tar will, therefore, be 12s. In our original article we set down the total value of tar acids "3 gallons carbolic and 3 gallons cresylic" at 7s. 6d. "Distillation" will therefore admit that there is a net balance in favour of the process of tar-acids recovery of 4s. 6d. over and above what we gave in our article on "Coal Tar and Its Products." Increased working expenses, if any, cannot materially alter these results, which are very favourably in excess of the figures originally given by us.

"Distillation" then accuses us of quoting 1913 prices, because these were more favourable than current prices for pushing the sale of our plants. Whatever might have been our motives in writing, or his

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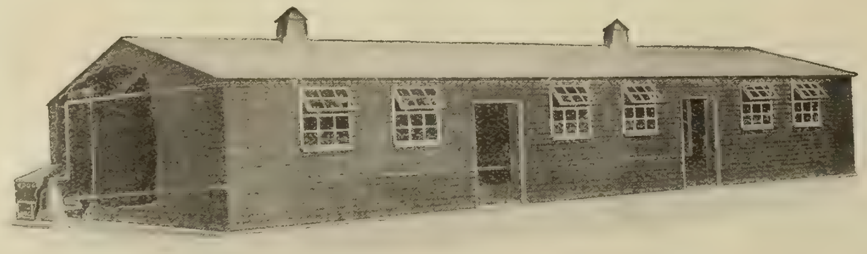

ARDEN HILL & CO.,
Acme Works,
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otives in criticizing the article, we can assure "Distillation" that we ve been exceptionally well occupied in erecting tar-plants for the last hteen months; and it may be that he is nearer the truth than he nks when he says: "Tar distillation plants would be springing-up ierever there were bye-product ovens and gas-works."

' Distillation" states: "It is known that large distillers are not reap- fortunes out of tar;" but somehow we are of opinion that the broad ts in this case are very much against his statement.

In the latter portion of his criticism, we cannot altogether say that)istillation" exaggerates; but from our knowledge of the facts we tainly think he is misleading. He states: "It stands to reason that h pitch, which constitutes from 60 to 70 per cent. of the products of tillation of average tar, realizing 15s. per ton at the works, and huge cks accumulating in the country, the distillation of tar is not making fabulous profits the firm would lead one to think." We get the lowing figures from a 30-ton-per-day plant, erected at a coke-oven rks by us: One ton of tar produces 80 gallons of oils and 12 cwt. of ch. The oils can be sold to-day at 5d. per gallon, and we will accept)istillation's" price of 15s. per ton for the pitch with the following ults:

80 gallons of oils at 5d. per gallon	£1	13	4
12 cwt. of pitch at 15s. per ton.		9	0
	£2	2	4
Less working expenses		5	4
Net value of products	£1	17	0

' Distillation" has already stated that "tar is difficult to sell at anyng over 12s. per ton." So deducting 12s. (his price) from the net ue of the products given above, we find a balance in favour of tar tillation at the present time of £1 5s. per ton. Our original article wed a net profit of 14s. per ton. We should very much like to know this agrees with "Distillation's" statement that the "distillation tar is not making the fabulous profits the firm would lead one to ik." We venture to suggest that "Distillation" will find it exceedly difficult to demonstrate that (1) tar should not be distilled at the nt of production, and that (2) it is at the present time an unprofite undertaking.

There is to hand a copy of the first catalogue of gas appliances issued by Messrs. M'Dowall, Steven, and Co., Limited, of the rieston Iron Works, Falkirk, who, though not hitherto very closely ntified with this particular line of business, have had over eighty rs' experience in ironfounding, and have for a long time specialized eating and cooking stoves and ranges. A separate gas-appliance artment has been organized, under expert management. Various erns of gas-cookers, &c., and fires are illustrated, prominent among n being Valentine's "Jura" adaptable kitchen range gas-circulator the "Ailsa" inset gas-fire.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Nov.* 22.

There is rather more inquiry for pitch; some buyers being anxious to obtain supplies. Business, however, is more than difficult owing to the excessive freights. Other tar products remain without change.

The upward tendency of sulphate of ammonia continues; the prompt price for 25 per cent. quality being £15 10s. per ton net, filled into buyers' bags, at makers' works, with a premium of 5s. per ton for the first four months of next year.

Pitch.

London, *Nov.* 20.

There has (Messrs. Blagden, Waugh, and Co. write) been a fair inquiry for pitch; but freight opportunities are extremely limited, and rates exorbitant. Consequently, shipments are on a small scale compared with available supplies. Business has been done during the week at 17s. 6d. f.o.b. works London; but sellers would like to see deliveries accelerated. To-day's value is 17s. to 18s. per ton f.o.b.

Tar Products in the Provinces.

Nov. 22.

Dealings in tar products are still on the quiet side. Business is reported in pitch at low prices; but the value must be taken as practically nominal, as one can only do business after having secured a firm offer of freight. In creosote, quiet business is reported at 2¾d. to 2⅞d. for country makes. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 9d. to 22s. 9d. Pitch, East Coast, 16s. to 17s. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Nov.* 20.

Throughout the week the market for this material has continued to advance, and at the close the tendency is still upwards, notwithstanding the delay in obtaining export licences. There has been large inquiry from Spain, but the number of transactions has been limited by the lack of available supplies. The nearest values are now £16 per

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The "ASTOR" Sola Gas-Fire.

The Fires that solved the problem of SILENT, HIGH-TEMPERATURE, Gas-heating and Radiant energy.

The Fires that raise the room temperature quickly, and are capable of use over a wide range of adjustment to meet our varied weather conditions.

The Fires that are unsurpassed for their HYGIENIC qualities of perfect heating and ventilating. The atmosphere of the apartment is changed without lowering the temperature or creating draughts.

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ton f.o.b. Hull. £16 5s. f.o.b. Liverpool, and £16 7s. 6d. f o.b. Leith. For future delivery no first-hand business has transpired; but it is reported that dealers have sold at about prompt prices for shipment during the next three or four months.

Nitrate of Soda.

The tone of this market has remained steady, and holders now require 14s. 4½d. per cwt. for ordinary, and 15s. 7½d. for refined quality on spot.

Sulphate of Ammonia.

From another source it is reported that the market for this article continues firm. Outside makes are quoted at £14 17s. 6d.; Hull, £15 12s. 6d. to £15 15s.; Liverpool, £15 17s. 6d.; Leith, £15 17s. 6d. to £16; Middlesbrough, £15 17s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The coal market is affected by the slow arrivals of steamers, which causes holders of coals to ease prices where ready shipment is possible. Apart from this, however, there is a good demand for coal generally, and forward prices are well maintained. In the steam coal trade, the difficulty as to tonnage is felt, because it is largely an export business. Best Northumbrian steams are steady generally at about 19s. to 19s. 6d. per ton, according to time and shipment; second-class steams are near 16s. 6d. to 17s. per ton; and steam smalls are in full supply at 10s. 6d. to 13s. per ton—all f.o.b. Some forward sales of steam coals have been made, for delivery over the first half of next year, at near 20s. per ton f.o.b. for best qualities. In gas coal, there has been some delay in shipment, owing to the lack of ready steamers, but the more settled weather is bringing steamers forward a little better. Best Durham gas coals are quoted from 19s. 3d. to 19s. 6d. per ton f.o.b.; second-class are 16s. 6d. to 17s.; while "Wear Specials" are from 20s., and are firm. The good demand for Durham coals for bunkering is strengthening the gas coal market. The output in Durham is fairly good, with the limitation of miners, and the output is readily taken up, even though the cost of the carriage is very high. The market quotation for freight on gas coal from the Tyne to London is now 14s., and to Genoa—which is a considerable buyer of Durham gas coal—the record freight of 52s. 6d. has been paid. At this time of the year, usually, heavy contracts for Durham coal are in the market; but the high figures for coal and freight deter long contracts at present. Coke is firm and rather scarce. The production of gas coke increases, and good makes are quoted from 27s. to 29s. 6d. f.o.b. in the Tyne.

Fatality at the Rochdale Gas-Works.—A verdict of "Accidental death" was returned by the Coroner's Jury who inquired into the death of a carter named Greenwood who was fatally injured at the Rochdale Gas-Works. He was tipping a load of coal down a shoot, between 30 and 40 feet deep, when he slipped and fell to the bottom, injuring his spine. The deceased himself attributed the accident to the tail-end of the cart giving way. The machinery was at once stopped, which prevented him from being carried along by the conveyor at the bottom of the shoot towards the crusher.

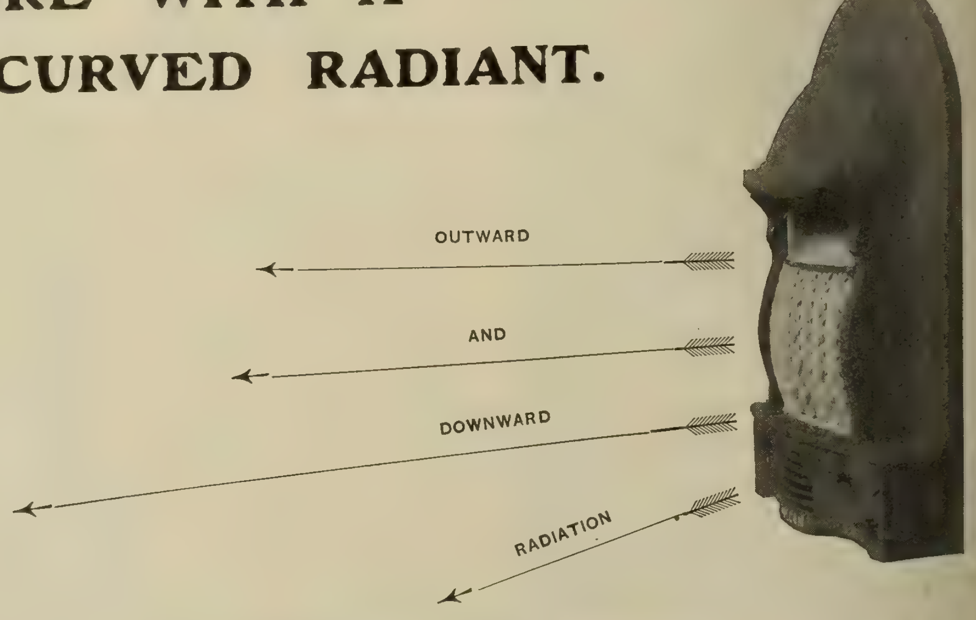
Extravagant Coal Consumption.—Professor W. A. Bone, lecturing at the Midland Institute, Birmingham, last week, on "Coal and Its Chemistry," described the composition and calorific values of fuel, the formation of coal beds, and the waste in coal consumption. It must be clear, he said, that the sordidness and ugliness of great centres of industry were largely due to the smoke nuisance, which deprived people of much of the beauty of form, colour, and light which might be enjoyed in Nature and Art, and spelt disease and stunted growth among so many of their fellow creatures. Dealing with the bye-product of coal, he pointed to the researches of German chemists and the large export to this country of synthetic dyes—an export which, he said, ought never to be allowed to recur.

Gas Companies and War Costs.—Presiding at a parish meeting at New Tupton, Mr. S. Sales gave some personal views on the duties of gas companies. He referred to the fact that the parishioners of Pilsley had determined to do without street lighting rather than pay the increased cost of 3d. per 1000 cubic feet demanded by the Clay Cross Gas Company, and said had there been any members of the general public present he should have advocated that they follow the example of Pilsley. This extra cost, the Gas Company urged, was occasioned by the war; and he thought it was a mean action on the part of the Company to pass it on to the consumers, instead of bearing it themselves. In his opinion, it was neither loyal nor fair. Other members complained of the quality of the gas; but the meeting passed a resolution which allowed for a precept being issued on the Overseers for a sum of money for lighting purposes.

Increased Prices at Brigg.—Considerable dissatisfaction has found expression at Brigg regarding the action of the Urban District Council in advancing the price of gas 7½ per cent., without giving notice. At a Tradesmen's Association meeting on Friday, it was decided to forward a resolution of protest to the authority; the especial injustice complained of being that the charge had been made retrospective, and that there was to be no increase of price to slot consumers. Mr. Stamp explained that the Council had saved the town £400 by the way in which they had purchased coal; but notwithstanding this, an increase in the price of gas was inevitable. He agreed that notice of the increase might have been given; but it was ascertained there was going to be a loss on the gas-works of £389, and an opportunity to deal with it was seized as soon as possible. The slot consumers were the best consumers; and to have altered their meters would have cost too much.

An Obvious Advance.

A FIRE WITH A CURVED RADIANT.



A Maximum of PURE RADIANT HEAT.

The "LANCET" says "This fire showed no escape of combustion products into the room whatever."

The "LANCET," June 12th, 1915.

MANUFACTURERS:
THE VULCAN STOVE CO., Ltd. EXETER.

Gas Profits and Income-Tax.

It was reported at a meeting of the Saffron Walden Town Council iat it had been decided to appeal against a Schedule D assessment on ie profits of the gas undertaking for the current year. In explanation, ie Chairman of the Gas Committee said the Commissioners had ssessed the undertaking on a much larger amount than the actual rofits. Mr. Gough thought the time had arrived when the Commit-e should consider the price of gas, having in view the cost of coal. he Mayor said he was afraid they could not alter the price again for early a year, as they had only recently fixed the rate for the current ear. Replying to a question, the Clerk said that, when the price was ked at 2s. 11d., it was "until further orders." This was done so iat the Committee might be in the position to alter the price at the id of the financial year. It was essential, in the interests of the due orking of the Committee, that they should fix the price of gas having gard to the cost of coal. Mr. Miller stated that when he proposed e reduction in the price from 3s. 2d. to 2s. 11d., he purposely worded s resolution "until further orders," so that the price could again be tered if necessary. The undertaking had been making a good profit; id it seemed folly to pay a heavy income-tax when it could be avoided. ie Clerk remarked that if they were going to alter the price three or ur times a year, it would seriously hamper the accounts. Mr. Gough plied that he was quite willing to leave the question until the end of e year; and the Committee's report was then adopted.

* * *

A Gas Loan.—A letter from the Local Government Board was read last week's meeting of the Rickmansworth Urban District Council, king what explanation the Council could give of their action in in-rring expenditure on the gas undertaking in anticipation of the ard's sanction to a loan. The Clerk was directed to reply to the ect that, whereas the war started in August, 1914, the Council on y 30 passed a resolution to apply for a loan. Since the war, how-r, no further work had been ordered.

Lincoln Gas Workers' Wages.—Affecting the local gas workers, ijointly with a large number of men engaged in engineering and ier trades, a meeting under the presidency of Mr. A. Shaw, of effield, was held at Lincoln last Sunday week, for the purpose of isidering an offer by the employers in response to the request re-tly put forward. The application by the allied trade unions had n for an increase of 6s. per week on the wages of all adult male rkers, an increase of 10 per cent. on piece work, and other conces-ıs. The employers refused the application, but, as a compromise, red to concede a rise of 2s. a week on day rates to all adult mem-s connected with the several organizations, including that of the gas kers. On a ballot being taken of the men, it was decided by a large jority to accept the offer. The increase comes into force on the 27th ., and is given on the strict understanding that no further demand is le during the period of the war, except for abnormal conditions. increase is not to apply to workers under 21 years of age.

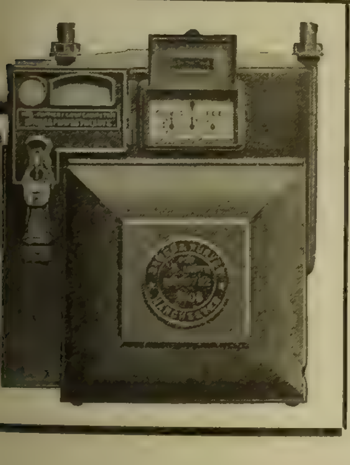
Coke as Boiler Fuel.

Writing to the "Yorkshire Post," Mr. C. D. Leng, the Chairman of the "Sheffield Telegraph" Company, referring to an article which had recently appeared on coke as boiler fuel, says: "Some fourteen years ago, when advocating smoke abatement in Sheffield, I tried some experiments on two Lancashire boilers. At that time we were burning 42 tons of washed nuts at 12s. 6d. per ton; and we made a certain amount of smoke. I read an article by Mr. Bryan Donkin on the cost of steam raising, and found that the local Gas Company had for sale a large quantity of coke dust. Messrs. Meldrum Bros. fitted our boilers with special fire-bars to hold the very fine fuel, and with forced draught; and we started to burn coke dust at 1s. 11d. per ton, with the result that for fourteen years we have made no smoke, and we have saved £18 per week in fuel. With coal, our fuel and the carting away of ashes totalled £28 per week. With coke dust, the fuel, the carting away of ashes, and wages of two extra stokers, totalled £10 per week. We were evaporating 1000 gallons of water at a cost for fuel of 2s. 4d. The curious thing was that, until we had completed our experiments, the Gas Company here were not aware that coke dust had any value as a fuel. They were paying carters to tip it. The war has interfered with prices. Both coal and coke are much more costly; but the saving in favour of coke is still in the same proportion. To save the cost of carting away ashes, we have induced the Gas Company to riddle the coke dust, to get rid of the fine powder or sand. We use a small quantity of soft coal dust to mix with the coke after the fires have been cleaned—about 1 ton of coal dust every 24 hours. The coke makes an intensely hot fire; but there is no long flame, as with coal, and it is necessary to have ample boiler power. We maintain 100 lbs. steam pressure night and day."

* * *

North Warwickshire Water Syndicate.—A Company with this title has been registered, with a capital of £15,000 in £1 shares, to adopt an agreement with the North Warwickshire Water Company, to manage and control water-works, &c. Minimum cash subscription £7. The number of Directors is not to be less than three nor more than five. The registered office is at No. 21, Ironmonger Lane, E.C.

Assessment of the Truro Gas-Works.—On the recommendation of the Assessment Committee, the Truro Board of Guardians decided to engage the services of Mr. A. Body, of Plymouth, to value the undertaking of the Truro Gas Company. Mr. Hearl said that a great many alterations and additions had been made at the works; and the mains had been extended in different parts of the city since the last valuation was made. The Committee could not assess the undertaking; and if they called in valuers they might come to some arrangement with the Company. Mr. Michell added that it would be useless for a representative of the Guardians or the Assessment Committee to meet the Directors unless they had all the information at their disposal. It did not follow that they would have to go into Court because they employed a Valuer.



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Radcliffe Gas Purchase Question.—At the last meeting of the Radcliffe District Council, it was resolved that the question of the purchase of the Radcliffe and Pilkington Gas Company should be deferred until the termination of the war.

Gas and Water Demands at Barrow.—Barrow-in-Furness is experiencing a largely increased demand for gas; and the existing carbonizing plant is being taxed to its utmost. While the consumption at present is 8,700,000 cubic feet per week, the total capacity of the works is only 9,000,000 feet. So acute has the position become that notices have been issued that the Corporation will cut the connection of all gas-cookers where coal-ranges are fixed in the houses. New gas-works are being built, but will not be finished for some time. As to the water, none can be drawn from Poake Beck, Pennington, and Harleck reservoirs in High Furness; and the town is relying upon the water from the Duddon Valley, supplemented by a quantity pumped from disused mines at Yarlside. Both gas and water are being largely used in the making of munitions of war. The military authorities have now taken possession of the gas undertaking, with the object of conserving and augmenting the supply of gas to Messrs. Vickers' works. They have, however, asked the Corporation to continue to work it, as their agents.

A Curtailed Gas Supply at Keighley.—"On the top of Keighley's eight hours a day water supply," the "Yorkshire Observer" says, "comes the announcement that on three days a week—Saturday, Sunday, and Monday—the gas supply will be cut off from 8 a.m. to 4 p.m. The water restriction was already bad enough for the housewife, and not a few factories and workshops; but the curtailment of the gas supply will make many housewives furious, for, roughly, there are 10,000 cookers, &c., in the borough, and the period of cutting-off covers the dinner hour. But the cold chop is as nothing compared to the loss which is bound to accrue to the workers at places where gas supplies the motive power, to say nothing of the dislocation of trade. It is a serious matter all round; and it is unfortunate that circumstances—not unconnected with the war—should have arisen at the darkest period of the year to prevent the earlier completion of the new carbonizing plant at the gas-works—a work which involves an outlay of over £20,000. Had everything gone smoothly, the work would have been finished by the end of summer. If the strictest economy is observed the period of curtailment of supply may not last more than two or three weeks. It does seem strange, however, that in a concern making nearly 400 million cubic feet of gas per annum some means could not be devised for 'carrying on' continuously."

STOCK MARKET REPORT.

Business on the Stock Exchange last week was quieter; and the more pronounced tendency in some markets was to tone-down the prices which had been attained in the course of some recent weeks of perhaps too marked buoyancy. Some degree of reaction, when there is risk of an advancing movement being carried too far operates as a wholesome check without impairing the esoteric strength of good lines. Among the markets which have cried a halt (to mark time for awhile) was the American, where Canadian as well as United States securities had a pause. But the actual conditions which make for Canadian prosperity remain unaffected. The big advances in the Foreign Market—Argentine Rails, South Africans, and others—felt the influence. On the other hand, Home Rails continued cautiously to gather strength. Among other lines, Banks were popular, and Rubber perhaps a little too much so. Sound undertakings in the latter line are all very well, and may thrive by the advance in the price of the raw article; but the public should leave all the questionable ones alone. In regard to general matters, further facilities for dealing have been conceded by the Committee; and the obligation to supply distinctive numbers in the case of sales of registered securities has been relaxed. The question of minimum prices is being pushed, and a lowering of the Consols figure is prominently in demand. The assent of the Chancellor is expected. He has introduced into the Finance Bill a clause to exempt foreign investors in our Government loans from income-tax. This should create a demand from abroad. The closing of the London banks at 3 o'clock will begin on Dec. 1. Business in the Gas Market made a retrograde step so far as activity is concerned; and the disposition to brighten up into something resembling the normal which was peeping out in the course of the previous week was not maintained. Prices showed no perceptible change. The Malta and Mediterranean Company will pay an interim dividend at the rate of 4 per cent. In the Money Market, rates were quite easy.

Bargains done for cash during the week were as follows: On Monday, Brentford new 85½, 86, Gas Light maximum 60, 60¼, ditto debenture 62¼, 62½, 62⅝, 63¼, Primitiva 2 5/16, 2⅜, South Metropolitan 76⅝, 77. On Tuesday, Bombay 5, Gas Light ordinary 76¾, ditto preference 73¼, 73½, ditto debenture 62¾, 63, Imperial Continental 69¾, Primitiva 49s. 6d., South Metropolitan 76½, 76⅞, 77¼. On Wednesday, British debenture 70, Gas Light ordinary 75¾, 76, 76¼, 76½, Imperial Continental 69½, 70¼, Primitiva preference 3½, ditto debenture 64¾, Tottenham "B" 97½, 98. On Thursday, Gas Light ordinary 75½, 76½, Ilford "B" 100, Imperial Continental 70¼, Primitiva (1911) 65½. On Friday, Gas Light ordinary 75½, 76, Primitiva 2 17/32, 2⅝, South Metropolitan 76⅝, 76¾, 77¼, ditto debenture 60½. On Saturday, British debenture 71½, Gas Light debenture 63, Imperial Continental 73, 73½, Metropolitan Melbourne 97½, Primitiva 2⅝.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	. . .
874,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	4/6	Bombay, Ltd. . . .	5⅞—6⅜	5 17 8	5
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c. . .	29—30	5 6 8	..
873,480	10	"	7	7/-	B 7 p.c. .	15—15½	4 10 4	..
95,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Deb. . .	..	—	..
880,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3	..
830,000	"	"	†11	55/-	Do. New . . .	204—209	5 5 3	85½—86
50,000	"	"	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb. .	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	7¼	Do. A Ord. Stk. .	154—159	5 0 8	.
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	71½
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	70
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref. .	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	"	"	5⅛	46/8	Do. 3½ p.c. do. .	103—105	5 1 6	..
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk. . . .	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk. .	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord. . .	98—102	4 15 6	75½—76¾
2,600,000	"	"	3½	3½	3½ p.c. max. .	76—79	4 8 7	60—60½
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10	73¼—73½
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	62¼—63¼
130,000	"	"	10	10	10 p.c. Bonds .	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C . . .	151—154	5 2 4	..
65,780	"	"	6⅝	6¼	Do. B	115—118	5 8 0	100
65,500	"	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	5 12 6	69½—73½
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7		B	146—148	4 14 7	..
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	4/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	97½
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B . .	128—131	4 19 8	.
100,000	50	"	12	60/-	Do. C . .	118—121	4 19 2	..
52,000	50	"	10	—	Do. D . .	..	—	..
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	6 18 4	2 5/16—2⅝
499,960	5	June 26	5	2/6	" 5 p.c. Pref. .	4¾—5	5 0 0	3½
521,600	100	June 2	4	4	" 4 p.c. Deb. .	91—93	4 6 0	64¾
—	—	—	—	4	" " " 1911	..	—	65½
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8	..
209,984	"	"	10	10	Do. B	222—224	4 9 8	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	76½—77¼
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60½
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	"	"	5	5	Do. 5 p.c. Pref. .	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent. .	..	—	..
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c. .	135—138	5 8 8	..
742,275	"	"	6	6	B 3½ p.c. .	115—117	5 2 7	97½—98
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 8	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/3	55/1½	" C 3½ p.c.	110—115	5 2 0	..
852,000	"	"	6⅛	57/6	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	"	"	6⅝	63/9	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

At a meeting of the General Purposes Committee of the Dewsbury
wn Council last Thursday, it was reported by the Economy Sub-
mmittee that the annual saving of £3692 included that on public
ıting—the largest—of £1500. The report was adopted, though not
hout bitter complaints by Alderman Sir Mark Oldroyd, who said
lighting of the town was a perfect scandal.

A Local Government Board inquiry was held recently into an
lication by the Todmorden Rural District Council for power to
row £700 for purposes of water supply to the Colden district. It
reported that work to the extent of £615, paid out of the general
d of the Council, had already been completed. The Inspector ex-
ssed surprise that this should have been done before borrowing
vers were sought, and was informed that there was a pressing neces-
for the work to be carried out. A West Riding County Council
itary inspector gave evidence that the County Council had been
ssing the District Council for several years to provide a new water
ply for the Colden district, and were undoubtedly of the opinion
t it was necessary.

The failure of a feeder-cable—owing to being overloaded with current used in the manufacture of munitions—deprived a part of Wolverhampton of its electricity last Wednesday evening. Lights, &c., were off for about forty minutes; and in some instances the power was not restored until after an hour-and-a-half had elapsed.

APPLICATIONS FOR LETTERS PATENT.

15,801.—STANIFORTH, H., "Gas-lamps." Nov. 9.
15,850.—HELPS, G., "Gas-burners." Nov. 10.
15,864.—DOWNIE, H. C., "Tap." Nov. 10.
15,926.—MUNTZ, W. E., "Taps or cocks." Nov. 11.
15,933.—RICHARDS, R. S., "Distillation of carbonaceous material for the production of smokeless fuel and the recovery of bye-products." Nov. 11.
16,022.—WILLIAMS, S., "Securing gas-connections." Nov. 13.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

ointments, &c., Vacant.
LERK. No. 6121.
ENTAL AND COUNTER CLERK. No. 6122.
AS-FITTERS. Sheerness Gas Company.

k Waggons Wanted.
ENCER CHAPMAN AND MESSEL, LTD., 36, Mark
Lane, E.C.
o. 6119.

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Controllers.
WARRINGTON GAS DEPARTMENT.

Fire-Clay Goods.
LEEDS GAS DEPARTMENT. Tenders by Dec. 4.

Lighting Stores (Mantles, Burners, Brass Goods, Glassware).
CALCUTTA CORPORATION. Tenders by Feb. 21.

Tar.
GLOSSOP GAS COMPANY. Tenders by Dec. 11.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

o notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

**OPY FOR ADVERTISEMENTS for the "JOURNAL" should be
eived at the Office NOT LATER than TWELVE O'CLOCK NOON ON
NDAY, to ensure insertion in the following day's issue.**

**rders for Alterations in, or stoppages of, PERMANENT ADVER-
EMENTS should be received by the FIRST POST on SATURDAY.**

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ler, 3s.; each additional Line, 6d.**

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Resists 4500° Fahr. Best for GAS-WORKS.
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THE Warrington Corporation Gas Department are prepared to receive TENDERS, not later than noon on Nov. 29, for about 500 CLOCK CONTROLLERS for Lamps.

Particulars on Application.
Gas Offices, Warrington,
Nov. 17, 1915.

LEEDS CORPORATION.
(Gas-Works.)

THE Gas Committee are prepared to receive TENDERS for the Supply of SILICA and FIRE-CLAY GOODS required at their several Works.

Specification and Form of Tender may be obtained at the Gas Offices, Market Hall, Leeds.

Tenders, endorsed "Fire-Clay Goods," addressed to the Town Clerk, Pearl Chambers, East Parade, Leeds, must be Delivered not later than Saturday, the 4th of December, 1915.

The Committee do not bind themselves to accept the lowest or any Tender.

W. B. Leech,
General Manager.

Gas Offices, Market Hall,
Leeds, Nov. 19, 1915.

THE Directors of the Glossop Gas Company are prepared to receive OFFERS for the surplus TAR produced at their works for One Year commencing Jan. 1, 1916.

The Tar will be Delivered into the Purchasers' Tank-Waggons at the Great Central Railway Company's Siding, Glossop.

Offers, sealed and endorsed and stating price per 200 Gallons, should be sent in to the Chairman of the Company not later than Saturday, Dec. 11, next.

The Directors do not bind themselves to accept the highest or any Tender.

Gas Offices, Glossop,
Nov. 17, 1915.

CORPORATION OF CALCUTTA.
NOTICE TO CONTRACTORS.

ADVERTISEMENT FOR TENDERS FOR LIGHTING STORES FOR THE YEAR 1916-17.

TENDERS are invited, in duplicate, for the Supply of LIGHTING STORES for Public Street Lamps and Municipal Institutions for Twelve Months from April 1, 1916.

Complete Specification and Descriptive Lists of Stores required, together with Tender Forms in Duplicate, may be obtained from the Lighting Superintendent to the Corporation, Fenwick Bazar Street, Calcutta.

The following is a brief summary of the principal Articles required:

(*a*) INVERTED and UPRIGHT INCANDESCENT GAS-MANTLES for Street Lighting.
(*b*) INVERTED INCANDESCENT GAS-BURNERS complete.
(*c*) GLASS CYLINDERS for Inverted Burners.
(*d*) GLASS PROTECTORS for Upright Burners.
(*e*) GLASS PANES for Street Lamps.
(*f*) BRASS ADAPTATION FITTINGS and UNIONS.

Samples are required where stated in the List; and these must be addressed to the Lighting Superintendent to the Corporation, Fenwick Bazar Street, Calcutta, carriage paid.

Tenders must include Delivery Free of all Charges at the Corporation Stores, Calcutta, including Duty and Insurance against Breakages. War Risk Insurance and extra Freight Charges (if any) to be separately stated.

The Corporation do not bind themselves to accept the lowest or any Tender, and will be at liberty to accept the whole or part of a Tender.

Tenderers may quote for any or all of the items mentioned in the list.

Payment will be made when Delivery is accepted.

Tenders must be addressed to, and will be received by, the Deputy-Chairman of the Corporation up to 2 p.m. on Monday, the 21st of February, 1916, when they will be opened in the presence of such Tenderers as may be present.

Each Tender must be enclosed in sealed cover, and superscribed "Tender for Lighting Stores."

No Tender will be considered unless accompanied by a remittance to the extent of 2½ per cent. on the total value of such Tender.

Tenderers must abide by the rules in regard to Tenders in vogue in the Corporation, and are required to submit Tenders in duplicate on the Corporation Forms above referred to.

J. N. Sen,
Acting Secretary to the Corporation.

Municipal Office,
Oct. 29, 1915.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 37, Walbrook, E.C.

PATENTS.—Handbook of Patent Law, by W. P. Thompson, F.C.S., M.I.Mech.E., C.P.A., International Patent Agent, 6, Lord Street, Liverpool, and Bradford and London. 16th Edition 1915, 242 pages. 2s. 6d. Post free. English Portion, 6d. "A useful guide to inventors. The subject is treated in a simple and concise manner."—Journal of Gas Lighting.

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VOL. CXXXII., No. 2742.] TUESDAY, NOVEMBER 30, 1915. [67TH YEAR.

EDITORIAL NOTES.

Private Bills, and Signs of the Times.

HE Private Bill work tabled for the next session of Par- ament is of an order which for small extent is without ompare within the memory of the oldest practitioner in is particular parliamentary line. Last session was an ttenuated one in this respect; but the coming session's ork will be nothing more than a shadow of that of one of e worst of pre-war times. All told, there will only be pproximately 10 per cent. of the number of Private Bills that sually claim in a single session the attention of Parliament; d, of these few, no less than a dozen will deal with gas atters, and there will be an isolated Provisional Order. here will be special features about some of the Gas Bills; t, in the main, the powers sought are of the now usual der—capital powers, extensions of limits of supply, land d works sanctions, sliding-scale adoption, co-partnership, and-by clauses, and the miscellaneous provisions which pear in every Gas Bill in which company or local thority seek to bring their statutory powers and rights reast of the times. The promoters of the Bills are all ompanies with one exception, the Northwich District ouncil; and among the companies are some big ones— e South Metropolitan, the Newcastle and Gateshead, and e Plymouth and Stonehouse Companies.

In connection with these last-mentioned and other com- nies, we see the reflection of certain general financial anges which preceded the war, and have become accen- ated by the war itself. At the last meeting of the South etropolitan Gas Company, the Chairman (Mr. Charles arpenter) spoke of the then largeness of the bank loan, d of the requirement, owing to the changes produced by rest in the industrial world and other causes, of invest- ent in, and of carrying, much larger stocks. There is also e difficulty, which set in long before the war, of issuing w interest-bearing stocks. All people have been wanting ore return on their money; and for many years, with a overnment security carrying 4½ per cent. interest, these low terest-bearing stocks will go begging—even more in the ture than in the past. In fact, it will be quite useless ing to place them. Thus we see that some of the pro- oters—the large Companies already named among them— e seeking relaxation from the old restrictions affecting pital issues. Variously, the promoters are asking to be owed to pay higher rates of interest on preference and benture stocks, to have the ratio of borrowing powers to pital altered, and to issue redeemable stocks. Parliament nnot refuse these requests for more elasticity and better ms in raising money—first, because statutory companies nnot meet their obligations if deprived of the wherewithal "carry-on;" and, secondly, because the Government have stituted through the war loan a new and higher standard return, backed by the premier guarantee as to the repay- ent of principal. While upon financial matters, another asure is noted which is a direct consequence of the war. is that of the Imperial Continental Gas Association, who seeking the ratification by Parliament of certain distri- tions which have been made among the proprietors during period of the war, notwithstanding that the Directors d no audited accounts to present, and were unable to pre- re a profit appropriation scheme, as statutorily required. hile in Parliament, the Directors are proposing to adjust er matters of a minor character which have been await- a suitable opportunity. These were all the subject of nment by the Chairman (Sir Charles Jessel, Bart.) at the ent meeting of the proprietors.

More than half the promoters are asking to have the quali- ive standard of their gas transferred from illuminating wer to calorific value. Gas undertakings are now work- hard for the Government and the country in connection with the recovery of the ingredients required for making high explosives; and partial distillation of the crude tar has had to be taken in hand by many of them in order to keep pace with Government requirements. Through this, the resources of the country in this regard have been increased; and it was a good thing for the Government and country that it was so, or they would have been ere this in a much worse predicament than that (and it was in all conscience serious enough) in which they found themselves soon after the war began. The Newcastle, Plymouth, Colchester, Hornsey, and maybe other Companies are asking for extended residual powers. Government work and the general trend of development—such as the treatment of crude tar to make it comply with the specifications of the Road Board for road purposes—combined with economy, have led gas undertakings into work not contemplated a comparatively short time since.

There are proposals for the purchase of gas undertakings. The Northwich District Council are asking for powers under the purchase clause incorporated in the Gas Company's Act of last session. The Aberdare and Aberaman Gas Company are seeking to absorb the Hirwain Gas Company; the Folkestone Gas Company contemplate annexing the Hythe and Sandgate Gas Company, and to have transferred to them the undertaking authorized by the Elham Valley Gas Order of 1912; and the Uxbridge Gas Company are looking forward to embodying the Eton Gas Company within their own system. Among other matters which will claim attention is a desire of the Hornsey Gas Company to have defined their limits of supply in relation to those of the Gas Light and Coke Company.

Although the Bills are few, they are not destitute of interest; and, so far as the powers sought can be judged from the outline supplied by the parliamentary notices, we see no reason for hoping anything other than that good fortune will attend them all.

Burdening Freights.

IN the "JOURNAL" for Aug. 24, an editorial article foreshadowed a repetition of heavy freights during this winter. There was, on the part of the shipowners, careful preparation for this movement. The prospects were sketched in the papers which devote space to shipping intelligence. There was a shortage of tonnage, no new mercantile ships were being built, the demands upon British shipping were going to be of extraordinary amount, many ships would be going farther afield than customary—in short, there would not be nearly enough tonnage to go round. The law of supply and demand would come into operation with a vengeance, and shipowners would, in the foregoing circumstances, make that "law" subscribe to their enrichment just as they felt disposed. That was the prospect a few months ago; and it has materialized.

The shortage of tonnage in relation to demand cannot be disputed. It has been fully recognized by the Government; and, in consequence, Orders in Council have been made which prohibit British ships from carrying cargo from one foreign port to another foreign port after to-morrow unless licensed to do so, and confer power on the Board of Trade to requisition ships for the carriage of foodstuffs and other necessaries. Relative to this latter matter, a requisitioning Committee (of which Mr. J. H. Whitley, M.P., the Deputy-Speaker of the House of Commons, is Chairman) have been appointed; and their functions will be to secure that tonnage shall be available *in case of need* for the carriage of foodstuffs, &c., and to prevent freights on such commodities rising to prohibitive rates. It is not clear whether the Committee will deal with freights on coal. We see no reason why not. Coal is a "necessary," and "et cetera" is a conveniently elastic term. The country is suffering a heavy burden by the ruling market freights; and it is time the Government did something in the way of putting some curb on the cupidity of the shipowners. Why they have hesitated so long is one of the mysteries of the times. The law of supply and demand as interpreted by shipowners allows of extraordinary rates of profit; and the war has proved over and over again the need for the qualification of the so-called law, which is now supplying more than a useful excuse. The shipowners have already done extraordinarily well out of the existence of war conditions, as can be exemplified in few words. The "Newcastle Daily Chronicle" stated last August that the market value of the shares of some of the cargo-conveying companies had, while other securities had had a heavy setback, risen by from 40 to 50 per cent.; and from another quarter we learn that profits of from 60 to 80 per cent. on capital have been recorded. It was last week stated in the daily papers that a steamer, built four years ago, which changed hands only a few months since for £61,000, has again been sold for £90,000. The shipowners are realizing phenomenal wealth, solely through the opportunities provided for them by the British Navy, and by the British public and British trade.

There is no justification for the exorbitant freights that now rule, any more than there was for those that ruled last spring, when, from the Tyne to London, 10s. 6d. to 14s. 6d. per ton of coal were common charges, compared with 3s. and under preceding the war, and as compared with the 3s. 2d. to 4s. odd per ton that the carriage of coal was variously costing (with their own vessels) the Gas Light and Coke Company, the Commercial Gas Company, and the Wandsworth Gas Company during the six months ending June last—including all additional expenses occasioned by the war, as well as interest and depreciation. The difference between these actual experiences and the freights demanded and commanded by the shipowners tells a tale which may be epitomized by the single word "plunder," for no one could possibly defend the present freights as representing a fair profit. At the beginning of this month, it was stated in one report dealing with market freights that 12s. per ton was being "conceded" from the Tyne to London; at the end of last week, the figure had risen to 14s. 6d. per ton, which is monstrous. But those who have to pay these prices are helpless. Only the Government can break down the imposition; and we hope this will be done through the newly appointed Committee.

The conditions are such that gas companies dependent on seaborne coal, and unable to possess ships of their own, are suffering acutely. The contractors will not under current conditions enter into contracts for freightage ahead; and the current market freights upon the cost of coal (even under the Coal Price Limitation Act) mean a sum per ton that is seriously crippling. One consequence of this is that unfortunately certain companies will shortly have to again raise the price of gas in order to obtain even a moderate return upon their capital. It is, of course, little use to-day, with second-hand ships saleable at fancy prices, talking about co-operation between a number of gas undertakings in this matter of sea transport; but, in view of the erratic conditions of the freight market, even in ordinary times, the policy of co-operative ownership and working should be a matter for future consideration. If the Commercial and Wandsworth Companies—to say nothing of the larger companies—find it is advantageous to possess their own ships (the Wandsworth Company owned vessels before the amalgamation with the Mitcham and Wimbledon and Epsom Gas Companies), we see no reason why a combination of smaller companies should not be able to profit by joint ownership and running on *pro ratâ* lines.

Over-Taxing its Strength—Present Demands and the Future.

Never has a gas undertaking, except perhaps in the days of a strike or a shortage of coal, been in a worse dilemma than is the Birmingham Corporation Gas Department to-day. There is no strike; and we can undertake to say the Gas Committee and their General Manager have seen to it that this winter shall not find the works short of coal. Yet for the second time within recent weeks, the Committee have had to prominently appeal to their ordinary patrons to economize in consumption—particularly by the sparing use of gas-fires, and during the coming two months which always produce the days of maximum output. It is the irony of fate that placed Sir Hallewell Rogers, the Chairman of the Birmingham Corporation Gas Committee, in the Presidential Chair of the British Commercial Gas Association—an Association for promoting sales of gas and educating the public as to its applications, conveniences, and thermal and other qualities—just at a time when he is compelled to say, and to say seriously, to the people of Birmingham: "Please "do not consume so much gas as you usually do during the "coming season of the year." It is awkward that necessity so compels; it really cannot be helped. We are, however, rather pleased than otherwise to see that the Committee have had to make a second appeal to the public, because the fact that the first appeal has not had sufficient effect, and that a second and more urgent one is necessary, testifies that it is a hardship for the public to relinquish any part of the liberty hitherto enjoyed to consume gas *ad lib.* We distribute our sympathies equally between the public and the Committee and the staff of the department.

The whole blame for this condition of things in Birmingham must be laid on the Kaiser and the domineering Prussian militarism, and not upon the Corporation Gas Committee because they foresee trouble if there is not economy with gas in the households of the city and district. A short time since it was stated that in the then previous six months the output of gas from the city gas-works had been 13¼ per cent. in excess of the output in the corresponding half year. Now the consumption is something like 30 million cubic feet per week in excess of the corresponding weeks of last year; and the weeks of ordinary maximum demand loom threateningly before the Committee. The vigorous activity in the district in turning out war material is the cause of this violent inburst on the Committee's resources; and the high-water mark of this special demand is not yet. The requirements for munitions work the Committee must meet at all costs. There must be no curtailment in that direction; the curtailment must be in the direction where least harm will be done, and that is among the ordinary consumers. There inconvenience will only be temporary. Of course, no forecast as to works' provision could take into account the necessities of a war of such extent, intensity, and duration as the present one. No blame attaches to the Committee or their advisers in this respect. The works as they stand are well able to meet the maximum weeks' demands, with a margin to spare for fluctuations. But the measure of possible requirement has been all upset by the abnormal conditions, which, being unknown, could not be legislated for. New carbonizing plant, however, is to be constructed as quickly as possible. Associated is another difficulty. The department has not at command the maximum amount of labour which they employed at seasons of maximum output in times of peace; and yet they have this embarrassing call upon them.

Sir Hallewell states that the demand for gas for munition purposes has not attained its maximum, and that there are further developments within sight. The condition suggests that the resources of the great capital of the Midlands are being strained to the utmost for munitions work. There must, however, be limits to accommodation and ancillary services even in a place like Birmingham; and while the factories and energies of the city are being taxed in this way, there are other districts that could do with a part of the wealth of work that is being enjoyed by this and other great centres. The war work has wide distribution already, owing to its immensity; and admittedly still greater distribution and fractionation would not subscribe to economy. It is only reasonable, too, that to the centres of greatest experience the largest demands should flow. But it means a lot of capital being put into the war (through munition work) which will not be lucrative, or but poorly so, when the war is over, or, at any rate, not for some time. But whatever additional capital is specially spent in connection with gas-works for meeting the requirements for war material can be looked upon as money spent a little in anticipation of ordinary needs. There are greater fluctuations in demand to be met by gas-works to-day than used to be the case; and trade and heating consumption will in future augment the variations. Provision has to be made for this; and any extra plant now installed will come in useful in this respect. The capital expenditure having been incurred, and the plant available for additional business, will also supply a good stimulus to effort to secure new business connections or increased use of gas by existing consumers. The gas industry has considerable scope in industrial and domestic purposes; and everything points to the best efforts being put forward in days which we sincerely hope are not far ahead to produce business developments of very considerable order. Our chief competitors are looking to that time; and there are signs that they mean to make a good fight for fresh business as oon as there is any release from the bondage of current ircumstances.

However, in this article we have run from the present to he future. Returning to the present, and to Birmingham, t is hoped the consumers will now heed the economizing ppeal of the Gas Committee, who naturally do not like urning business from their door, and would not do so if it ould be avoided. But we are living in strange times, in imes of unusual requirement, and strange things have to be one. This is one of them; and the gas consumers must atriotically put themselves to a little inconvenience in order hat the factories of Birmingham and the district engaged on ar material may have their efficiency and volume of output aintained at the highest possible level.

Lighting of Works' Yards—"Side Issues."

HE members of the Illuminating Engineering Society last uesday had a discussion on the first report of the Comittee appointed by the Home Office to consider the subject f the lighting of factories and workrooms. The discussion as opened by the reading of an interesting paper by Mr. eon Gaster, the principal feature of which was the marhalling and dealing with the published comments on the eport. There were two or three criticisms of the recomendations regarding minimum values; but the general ndency of the discussion was a desire that the Committee hould go farther than they have done.

As to the criticisms of the recommendations about miniaum values, with one exception, they were not serious. he exception was furnished by Mr. A. Cunnington, who as a large experience of lighting in connection with the ondon and South-Western Railway Company; and he uestioned the prescription of "not less than 0·05 footcandle" illumination for open spaces, such as goods yards. e finds 0·01 foot-candle is sufficient; and he instanced yard where this is the minimum, and the cost of the lightg is £300 a year. This cost, he says, would be raised to 1500 if the 0·05 foot-candle were settled as the legal miniaum limit—an increase that would be a serious business for e yard. In this connection, we questioned the adequacy the 0·05 foot-candle, if enacted without qualification, for open spaces or yards of works and factories; and we did with experience of works where dangerous conditions ound during the hours of darkness, unless anyone is well customed to the pitfalls, and knowledge causes an exerse of due care. Mr. Gaster, without mentioning the name the "JOURNAL," says: "I notice that in one journal the uggested value of 0·05 foot-candle in such areas is spoken of as absurdly low." What we actually said was "is absurd *as a general* prescription." And the recommendan does suggest making it a general prescription. This how it reads: "In *all* open spaces in which persons are employed during the period between one hour after sunset and one hour before sunrise, and *in any dangerous parts* of the regular road or way over a yard or other space orming the approach to any place of work, the illuminaion on the horizontal plane at ground level shall be not ess than 0·05 foot-candle." So that this prescription, it intended, shall cover not only open spaces, but "any langerous parts" over the ways leading to any place of rk. In other words, there is no difference made between pen spaces" and the "dangerous parts" of the roads ough the works. We know of many yards in which in the en spaces the 0·05 foot-candle, or even Mr. Cunnington's 1 foot-candle would suffice. But in these same yards re are several ways of reaching the many places of work ere a higher minimum value would be preferable. Supse an Act of Parliament was passed in which the Comttee's recommendation that the illumination should not less than 0·05 foot-candle for open spaces were adopted hout qualification, what would happen in the case of an ident, and an action followed in which negligence was ributed through ill-lighting? If the illumination was ot less than 0·05 foot-candle," the owners could set this as a defence, and offer, as proof that they were not gligent, the prescription of the Act of Parliament. In opinion, something more ought to be done to discrimie between "open spaces" and the "dangerous parts" in ds, and not, an hour after sunset, give the owners of the rks a protecting point (this, of course, would not refer to ployers' liability or workers' compensation cases), in pect of "dangerous parts," as low as 0·05 foot-candle. yway, before the recommendation is put (if ever it is so put) definitely into an Act of Parliament, it would have to be hedged about with certain qualifications.

In another part of the paper, Mr. Gaster says that a few of the criticisms of the technical papers are based on the impression that the merits of one or another illuminant have not been sufficiently emphasized in the Committee's report. He ventured to think that the partizans of particular illuminants do not sufficiently realize how greatly these "presumed" advantages depend upon local circumstances, and how frequently some "apparent drawback" is due not to intrinsic defect in the illuminant as much as to the unsatisfactory manner in which the illuminant is used. Then he goes on to say that it is better to aim at constructive work of value to the public and industry as a whole than to embark on "controversial side-issues." There is a genuine vagueness about all this; and it is not definitely known what Mr. Gaster is referring to when he speaks of "presumed" advantages, and "side-issues." We can make a shrewd guess; but if the Committee are aiming at "constructive" work, they cannot afford to ignore "presumed" advantages or disadvantages, "intrinsic defects," and even what Mr. Gaster is pleased to term "side-issues." Part of the "constructive" work is acknowledged to be the protection of the eyesight of workers, and is, in this connection, glare, intrinsic brilliancy, the composition of light, eye fatigue, due to the character of lights, "presumed," advantages or disadvantages, and merely controversial "side-issues." Over them the Society of Illuminating Engineers have profitably spent much time; and they constitute the very lines along which certain speakers—Mr. W. R. Cooper, Mr. Justus Eck, and others—are anxious that the Departmental Committee should pursue their work. Mr. Cooper spoke of the high intrinsic brilliancy of the metallic filament lamp, and of the still greater defect in this respect of the falsely named "half-watt" lamp. Mr. Justus Eck was pained over the extending necessity for spectacles.

However, the intrinsic defects of the lamps in question can, of course, be mitigated and made practically or wholly innocuous by merely screening them from the eyesight of workers. But a considerable number of engineering shops and the rooms of many factories do not lend themselves to the adaptation of indirect or semi-indirect lighting with the same ease as the drapery and millinery shops of the West-end; and the attempt to adapt such systems in some such places would mean the eviction of lighting economy and efficiency. If, in this matter, the Committee want to be constructive, if in this matter they really desire to be benefactors to factory workers, then they cannot afford to be shy. If one form of light has objectionable defect in greater degree than another—a defect that is injurious to the precious optical organs—then let them say so, and at the same time tell factory owners and architects how the defect can best be dealt with so as to make it absolutely harmless to the workers, who are in the unfortunate position of being compelled to labour under the light that their employers think is the best or is sufficient for them. If, in cases, correcting devices cannot be readily applied, then let the Committee tell the factory owner which light of the two is, without the correcting devices, the less harmful to the eyes of his workers. We, like Mr. F. W. Goodenough, do not want the Committee to hurry unduly with their work. It is a case in which the greatest good will accrue by proceeding slowly, though it is hoped it will not be too slowly. But we understand that the Committee desire their work to be constructive, and they themselves benefactors to factory owners and workers, and through them to the country.

Candle Power from a Ton of Coal.

The President of the Institution of Electrical Engineers (Mr. C. P. Sparks) has exposed himself to considerable criticism if one liked to be ungenerous. He says: "Apart from hygienic reasons, it is certain that electricity will prevail more and more as an illuminant, owing to the greater number of candle-power-hours that can be obtained from a ton of coal by using electricity as compared with gas. With electricity generated in modern power houses using 25 B.Th.U. per watt-hour, and with 85 per cent. efficiency of distribution, the number of candle-power-hours obtained per ton of coal is, with metal filament lamps of 15-candle power to 20-candle power no less than 750,000, as compared with 260,000 in the case of gas—gas mantles of 20 candle power and 13,000 cubic feet of gas per ton of coal carbonized being assumed.

The amount of coal required with electricity for small units of light is thus only one-third of that necessary for an equal "illumination with gas." That is a very narrow comparison. We are not particular about questioning Mr. Sparks' figures. It is not really worth while. But, in passing, it may be pointed out that Mr. Nicol, in his letter in last week's issue, stated that, in a modern turbine generating engine, 1 ton of coal on the average is converted into about 746 Board of Trade units. Now if an efficiency of 1 candle per 1·25 watts is allowed, using metallic filament lamps, we have per unit 800 candle-hours, which makes per ton of coal 596,800 candle-hours, and not 750,000. But the comparison by Mr. Sparks is a senseless one. The consumer has no care as to the candle-power-hours obtained per ton of coal. His interest, as a rule, lies in another direction; and that is as to which illuminant can give him the greatest number of candle-power-hours for any given coin. Candle-power-hours are not the only things produced by the gas industry from a ton of coal. There is the coke, the tar, the ammoniacal liquor, and the multitude of necessaries to the world recovered from the last two bye-products. The electricity supply industry does not put its coal to this profitable use. If the gas industry wishes—and it does do so with some part of its coke—it converts it into water gas, and so the ton of coal yields (when this is done) many more thousands of cubic feet of gas than the 13,000 spoken of by Mr. Sparks. This gentleman took too limited a view of his subject. He should study it afresh; and at the same time consider the thermal value obtained from a ton of coal by the electrical method and by the gas-making process. He may in this connection find Mr. Nicol's letter of last week helpful to him, excepting that he may take it the 3 gallons of tar mentioned there should be 10 gallons.

The Industrial Gas Salesman.

Frequent reference has been made to the fact that the complete gas salesman must to-day be a man who has not only all the attributes essential for commercial work, but those requisite for carrying on the work with technical efficiency. It is not every gas salesman who has the capacity which will enable him to get beyond purely commercial work; and such a man is of no use whatever for the development of the industrial branch of the gas industry's business. He may do it more harm than good. In a paper which Mr. B. W. Brooks, the Special Representative of the Gas Light and Coke Company in their industrial gas work, read to the London and Southern Junior Association last Friday, a point is made, right at the outset, of the requirements of the industrial gas salesman. He defined an ordinary salesman as a person capable of creating a desire within another person to become possessed of a certain article. But in connection with the applications of gas to industry, he must possess more than ordinary qualifications—chiefly (said Mr. Brooks) constructive ability. A good deal more than this must be incorporated in his talents. The opportunities for gas in industry are so multifarious and so different that the man who can creditably and successfully fill the post of salesman and adviser must be a man with a good range of gifts. Before constructive ability can be exercised, the same person must have the capacity for investigating and assimilating information as to processes in the different local industries in which heat is required; and then will come in the constructive ability, and the capacity to practically demonstrate the suitability of the recommended appliances. The various example processes in which gas is used, and with which Mr. Brooks deals, each with a conciseness that is in itself admirable, to say nothing of the thousand-and-one other uses of gas in industrial operations, indicate the considerable capacity that the man should possess who essays to take control of this particular branch of the business of a gas undertaking supplying an industrial area.

A Suggestion.

Here is a point which, whatever reasons may exist for the state of affairs it reveals, is well worth consideration by British manufacturers. It is on the subject of foreign competition for trade in Argentina, and is contained in some information received from a reliable source by the Commercial Intelligence Branch of the Board of Trade. In the five years from 1908 to 1912, the United Kingdom, France, the United States, and Germany supplied about two-thirds of the imports into Argentina. One-third of the imports from the United Kingdom consisted of coal and material for railways, and over one-third of those from the United States were represented by timber, crude oil, and lighting oil. Taking the year 1913, and excluding these items, the increase in the imports over 1908 was 89 per cent. in the case of Germany, 57 per cent. for the United States, 40 per cent. for France, and 33 per cent. for the United Kingdom. It is pointed out that, owing to the war, former German sources of supply are stopped or curtailed, and that it is quite possible all articles in which Germany had a trade with Argentina can be replaced by British, French, or American goods. As a matter of fact, out of every hundred classes of goods supplied by Germany, only 26 are not in competition with the three countries named. Of Germany's total export trade to Argentina, 85 per cent. of its value was in competition with the United Kingdom, France, or the United States. Strong efforts are, it is stated, now being made by these countries to take advantage of the situation created by the war, especially in respect of the articles most in demand, which are German goods. A list is given of those things in regard to which the requirements would under normal conditions be satisfied by German manufacturers, and which should consequently now offer exceptional opportunities to British manufacturers. Among these goods, it is noticed, are included gas-pipes, wrought-iron tubes, and connecting-pieces.

British Engineering Organization.

The circumstances which have thus given rise to a hint from Argentina, are also referred to by a Special Committee of the Engineers' Club, who have drawn up some recommendations as the result of a year's discussion, not only by them, but by members of the Club, and by many distinguished engineers and men of commerce, who have taken part in the debates, in order to organize the British engineering industry. The Committee preface their recommendations with the remark that, as the result of their deliberations and inquiries, they are convinced that the British engineering industry must organize without delay, to take advantage of present opportunities, and to meet the conditions which will follow the termination of the war, "when our opponents, whose export trade has for the moment practically disappeared, will renew with increased fervour their characteristic methods of conducting a trade war against our industries." The only thing that is needed, the Committee think, is an organization which embodies a broader and loftier view of the responsibilities, the opportunities, and the powers of our engineering industry. They remark that the development of our engineering export trade, in particular, has been highly unsatisfactory for some years, while Germany's rate of progress has been phenomenal.

A Representative Association Proposed.

To meet the circumstances, what is wanted, they say, is voluntary organization and co-operation of the whole industry and they suggest the formation of an association on a non-tradin and non-interference-with-prices basis, to comprise British manufacturing concerns in all branches of engineering. The association should "aim at the inclusion of every such concern, have constitution giving it a legal status framed on broad principles and possess an efficient and energetic management." Such a association, if it could be formed, would no doubt be capable o doing all the good things—and they are many—which the Committee set out as possible in their report. But the securing "every" eligible member is usually a lengthy task in connectio with an organization of any character—proof of which, it ma be parenthetically remarked, has been provided in connectio with the gas industry. An annual subscription of one-tenth 1 per cent. of the £300,000,000 invested in the British engineerin industry, would certainly produce £300,000, with which a ver great deal could be done to combat German trade methods; b some hard work, we are afraid, lies ahead of whoever tries collect this sum. It should be added that the opinion of th Committee is that the multiplication of organizations is undesi able; and if an existing organization would so modify its cons tution and extend its operations as to give effect to their sugge tions, it would be better than establishing a new association. Th undesirability of multiplying organizations, if avoidable, is e dent; the only doubt is as to whether any existing one will f itself capable of adequately filling the *rôle* suggested for it admirable as the proposals are.

The gross amount of the personal estate left by Mr. Josep Hepworth was £46,985; and by Mr. Adam MacPherson, of Ki caldy, £23,858.

STANDARDIZATION OF THE QUALITY OF THE GAS SUPPLIES IN THE UNITED STATES.*

THE Bureau of Standards at Washington has recently issued a hird edition of the "Circular" dealing with regulations for con- rolling the character of gas supplies, of which the first edition as issued in the spring of 1912 [*vide* "JOURNAL," Vol. CXVIII., p. 501, 576, and 634], and a second edition in October, 1913 *vide* "JOURNAL," Vol. CXXIV., p. 801].

The present edition contains much more matter than the first, nd there has been a general re-arrangement of it. The circular now divided into five parts, of which the first is a discussion of chnical specifications, the second deals with the enforcement of chnical regulations, the third with proposed forms for regula- ons, the fourth gives a summary of laws in force, and the fifth eats briefly of the manufacture and distribution of gas. Appen- ces contain a number of tables of statistics of gas supply in the nited States.

The Bureau of Standards in its circular assumes that checks ust be imposed by the State or public authorities on gas under- kings in order to ensure that the consumers of gas get the rvice which they require. What would be the fate of a gas dertaking which, unhampered by such checks, proceeded to ovide a gas supply which was other than that required by its nsumers, is a question which the Bureau does not try to raise. aving regard to the fact that for all the principal uses of gas at e present day the gas undertaking is faced with keen competi- n from electricity supply undertakings, oil, petrol, and carbide alers, and coal merchants, it is fairly obvious that the share- lders in a gas undertaking, in their own interests, would not ow their officers to render a supply to the public which would t afford the best service which gas can give.

Unless there are conditions of gas supply in the United States America of which we are not aware, we cannot but think the reau of Standards has taken a retrograde step in endeavouring further the establishment of State standards of quality and thods of testing when the whole tendency in this country, where ch standards have prevailed for many decades, is towards their dual removal, and, one may predict, eventual abolition. The y proved effect of the imposition of such standards on gas dertakings, in nine cases out of ten, is the enhancement of the ce of gas to the consumer. Any collateral advantages to him negligible in the present competitive conditions. Half, or haps even a quarter of, a century since, there was perhaps ne adequate ground for the imposition of State standards of quality of gas and control of the same by testing; but it is a tter of surprise to us that the Bureau of Standards of a pro- ssive country does not appear to have realized that times and ditions have changed.

Vithout labouring this point further, if it be conceded that te standards for public gas supplies are necessary or desirable, new edition of the circular issued by the Bureau of Standards Washington furnishes a lot of excellent suggestive material. discussion of technical specifications, which occupies the part of the circular, purports to consider only the technical visions as to the quality of gas and gas service; but it is nitted that regulations for ensuring satisfactory service must considered from the standpoint of their probable effect on the and selling price of gas. In fact, the economic aspect of gas ply overshadows all academic considerations. Candle power dmittedly an obsolete criterion of the value of gas except to a ll number of consumers who deserve little State support for r conservatism in preferring wasteful methods of consuming

The Bureau rightly states that the tendency is towards the ption of heating values only. "A nominal candle power gas be sufficient for use in the few places where an open-flame ner is preferable to a mantle light. . . ."

Vith regard to heating value, the Bureau recommends the total ross heating value of the gas as more suitable for use in tech- l specifications than the net heating value. There is an inte- ng discussion of the question whether the standard illumi- ng or calorific value should be based on the cubic foot of gas ding under the average local barometric pressure of the dis- of supply, or whether the standard pressure of 30 inches of cury should be accepted universally. The question is obviously which bulks larger in a country where there are many great rences of altitude, and is of relatively little importance to gas umers in this country, where gas is seldom consumed at alti- s much above 1000 feet. A difference of 1000 feet in altitude s the mass of gas in one cubic foot only to such an extent the calorific value per cubic foot differs by about 3 per cent. e, however, at 1000 feet the boiling point of water is lower bout 2° than at sea level, about 1¼ per cent. less heat is ired to raise water from ordinary temperature to boiling at that altitude. This is some set-off to the consumer for per cent. reduction in the calorific value of a cubic foot of due to the attenuation of the gas by the low barometric pres-

We think that the Bureau has taken no account of this point in its discussion about the merits of standard pressure against average local pressure for a cubic foot at the gas-testing station. The Bureau recommends that in general gas supplies should be of 600 B.Th.U. gross per cubic foot, although in cases where unenriched coal gas or bye-product oven gas is sold 570, or even 550, B.Th.U. might be a more reasonable standard. Clearly this is a matter which must depend on the coal and oil supplies of each country; and it is possible that, having regard to the immense oil resources of the United States, the Bureau is justified in suggesting a standard of calorific power which is appreciably higher than that which has been found to be the most economical in Great Britain.

The discussion of testings of illuminating power deals at some length with the effect of altitude on the light of flame standards of light, and of gas-flames. The circular states, on the basis of results of tests which have not yet been published, that "the current method of testing gas for candle power is such that the candle power reported for gas at high altitudes is greater than its actual value, but usually somewhat less than sea-level value for gas of the same composition." The Bureau considers that "the actual candle power of the gas under the conditions of use of the gas should, if possible, be the basis of rating, for the same reason that the actual heat delivered should be the basis of the heating value to be specified." The circular implies that the candle power of the standard lamp has been over-rated in the past, owing to the lack of precise information as to the variations of candle power with atmospheric pressure. This information, it says, will shortly be supplied; and then it will be possible to rate pentane and other flame standards according to their actual candle power in different average atmospheric conditions.

In this comment the Bureau appears to have ignored the careful determinations of the effect of changes in atmospheric pressure on the light of the pentane 10-candle lamp and other flame standards which have been made in this country. It will be interesting to observe whether the results of the Bureau's observers, when published, differ from those of British observers. The relative effect of differences in barometric pressure on the light of the flame standard and of the gas-flame of the testing burner is of much smaller importance here than in the United States, owing to the fact that no towns in this country are at any really considerable altitude.

The Bureau adheres to its former preference for the flat-flame burner, consuming gas at the rate of 5 cubic feet per hour, as the standard test burner. This is, in part, due to the fact that gas of 600 B.Th.U. gross is unlikely, in the present conditions of gas manufacture, to afford less than 12 candles if coal gas, or less than 18 candles if water gas, when consumed in a good flat-flame burner at 5 cubic feet per hour. Generally speaking, the Bureau thinks the gas supplied should be of 14 to 16 candle power in flat-flame burners; but in the few American States where coal gas only is made, or where coke-oven gas is supplied, from 10 to 14 candles may be prescribed.

In regard to purity, the Bureau considers that sulphuretted hydrogen may be somewhat more objectionable than other sulphur compounds; and it would impose a test with lead acetate paper with carefully defined conditions which gives it a practically quantitative significance. Where the presence of sulphuretted hydrogen in gas is detected, the company should be allowed three days in which to take steps to ensure its removal from the system; and penalties should be imposed only if sulphuretted hydrogen is detected after the lapse of this time. The Bureau suggests that the company should be required to supply gas containing not more than 30 grains of sulphur per 100 cubic feet, which limit it considers will give relief to the company in localities where coals containing much sulphur are used. It states that there is no difficulty in maintaining sulphur in water gas below 20 grains per 100 cubic feet. Clearly, the admissible limit for sulphur in coal gas must, in the absence of special purification for the removal of sulphur compounds, be fixed solely with regard to the available supplies of coal in the country, and the limit of 30 grains may be reasonable in America, whereas it would be too high for Great Britain.

The Bureau thinks it is best to prescribe a limit for the amount of ammonia permissible in the distributed gas, and to test once a week, without warning, to ascertain that the limit is complied with. A 5-grain limit, it is said, would usually be proper; but in the case of a few works, it might be necessary to extend the limit to 10 grains per 100 cubic feet. No limit is required for works which produce water gas and oil gas only. The Bureau is not favourable to the imposition of a limit to the amount of carbon monoxide, chiefly on the ground that a large proportion of the cases of death or illness caused by gas poisoning are suicidal, or due to drunkenness or gross ignorance, and that a small reduction in the proportion of carbon monoxide in the gas would not appreciably diminish the seriousness of the results in these cases.

In regard to pressure, the Bureau suggests that both maximum and minimum pressures should be prescribed—the manner of doing so being to fix a normal, or standard, pressure, and to make the requirement that the pressure shall never vary by an amount more than 2 inches above or below the normal pressure. Further, the maximum pressure should never be greater than twice the minimum pressure. Alternative prescriptions are suggested; but, generally speaking, the object of the Bureau appears to be to secure to each consumer a supply of gas at a sufficiently high pressure, and to prevent any excessive fluctuations in pressure. Whether a gas undertaking nowadays would be so misguided as

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Circular of the United States Bureau of Standards," S. W. Stratton, tor. No. 32. Standards for Gas Service. Third Edition, issued 10, 1915. Department of Commerce, United States of America. ington; 1915.

to supply gas at an inadequate pressure, and thereby risk losing its customers, appears to be a consideration which the Bureau has overlooked. Experience in this country shows that, even where pressure prescriptions still remain in Acts of Parliament, testing for pressure has fallen into desuetude.

The second part of the Bureau's circular, relating to the enforcement of technical regulations, discusses the general regulation of gas supplies by the State Authorities as distinct from the Federal Government, and the inspection or testing by municipal authorities. This subdivision of the public control of gas supply has necessarily no parallel in this country, though it may well be essential in a country covering so wide an area as the United States of America. If Wales, Scotland, and Ireland were granted Home Rule, there might be a set of different model clauses for Gas Acts for each of the three countries, each differing from one another, and from the English set, and each applicable only to the gas companies operating in the particular country. If this were the case, it would be desirable for some central authority, similar to the Bureau of Standards, to attempt to unify the model clauses throughout.

The general tenor of the proposed forms for regulations, which are dealt with in Part III. of the circular, has been indicated in the foregoing review of Part I., and need not be discussed further. The summary of the laws in force is given in Part IV. These laws are divided into two groups—*viz.*, the regulations made by State authorities, of which those in force in 31 States are quoted, and the regulations of municipalities, of which a tabular statement is given. This summary should prove useful for reference when questions of prescriptions for the control of gas supplies are under consideration.

The fifth part of the Bureau's circular contains a concise statement of the composition of town gas, and its method of manufacture and distribution. It is intended to assist persons unfamiliar with the gas industry to grasp the reasons for the recommendations which the Bureau has made in its circular.

The circular bears evidence of very careful compilation and revision; and while we think its recommendations as a whole would, if adopted, inflict a superfluous burden on the gas-using community, there is no question that, from the standpoint of the compilers, the circular represents a conscientious effort to render the public a service. We could wish that so much care and energy as have been expended in its production could have been directed into more useful channels.

ELECTRICITY SUPPLY MEMORANDA.

Lighting Efficiency and Factory Output.

THE days of the old muddled methods of providing for the illumination of factories and workshops are slipping into the background; and we hope in time to see the crudity in this matter something that has only historical representation. A lot has of late years been learned about such lighting; and the piecemeal information of these years has now, for the edification of all concerned who desire to be edified, been packed together in the recently issued report of the Home Office Lighting Committee. The disposition of lights just as it suited the arbitrary notions of the fitter, or in rows with mathematically measured spacing, will not do to-day if artificial illumination is to contribute to factory economy and efficiency. The selection of the units of lamps that should be employed must also not be left to the mere opinion of the fitter. Illumination—both general and local—must to-day fit the place and the work, must aid in the performance of the latter and in raising the efficiency of factories, and so contribute to an increase of output. It must also subscribe to safety. We have before referred to the importance of the subject, in view of the pressure upon factories to-day in connection with war work. A great deal more work is now being done in factories at night time than ever before; and this is a good reason for seeing that the lighting is of the best possible order for facilitating the realization of the maximum result in output. In this matter of scientific and efficient illumination, the gas industry must not be behind the electrical industry. We notice that the General Electric Company are discerning. They see in the present a fine opportunity for pressing their wares in the way of lighting fittings, and they make a point of what is grandiloquently called an "illuminating engineering department," to advise on all lighting problems. The department is said to be fully equipped for the design of new installations, and for the remodelling of old ones. The Company are thus disinterestedly willing to transfer the task of planning-out illumination systems from the layman to the expert—that is to say, they offer to place the intellectual and trained resources of the department at the service of factory owners, in order that their establishments may contribute to the attainment of the highest possible efficiency.

Progress in Efficiency.

Naturally the Company want to get something out of this enterprise; and that is a very proper desire. The scheme is simply a way of getting business; and it is both a legitimate and an enlightened way. Factory owners, however, who think that, by having recourse to the department, they are going to get something for nothing, must not feel disappointed when the estimates come in. Such departments are not kept running without cost. When these excellent people design installations if they wish them to be scientifically accurate, and innocent of harm to the optical organs, they will probably advise the use of half-watt lamps, with the shielding bowls or other devices which are essential to the lamps, and which help to supplement revenue, and so the user's initial expense. It is one of the grand things about the evolution of electric lamps, that, with all new advances in efficiency in relation to consumption, it becomes more and more imperative that auxiliary devices should be adopted to prevent the offensively glaring lamps doing injury. The manufacturers of electric fittings have no objection to advances that bring more grist to their mills. But the fact remains that manufacturers of incandescent gas-lamps—low and high pressure—can put before factory owners scientific schemes of lighting (without compelling a large outlay on all sorts of auxiliary appliances) which will not only give high illuminating efficiency, but will help to the visual efficiency of the workers, without damaging their sight. We hope the lamp manufacturers of the gas industry are following up the Home Office Lighting Committee's report, and trying to get new business from factory owners, by offering expert assistance. Now is their time. Of course, factory proprietors may say they are much too busy on munitions work to at present give attention to changes of the kind; but if the proposition is one that will add to their capacity for carrying-on munitions work, they ought not to be too busy to give it consideration. The country wants everything done that can be accomplished to increase output, and improved illumination is a means of doing this.

Dangerous Installations.

But there is a good proportion of factory owners who, unless they are subject t inspection and penalty for default of regu lations, will not move from their old ways It is passing strange that so-called business men should nee compulsion to produce economy and increase works' output, whic mean to them additional profit. But so it is. And in this matte of illumination it is not possible, during war time, to get immediat legislation which, as in the case of sanitation and other matters will act compulsorily. Good evidence of this indifference is foun in the report of Mr. G. Scott Ram, the Chief Electrical Inspecto of Factories. Time after time, he has complained of the neglec in factories of the Home Office electrical regulations; and, in th report just issued, he again refers to the trouble. Under the com petitive system, contractors put in inferior apparatus and material on account of cheapness; and (the Chief Inspector omits to men tion this) where there is not competition, the factory owners hav to pay through the nose for installations. But the inferior app ratus means that the factory occupier has to suffer, and has incur greater expense in having matters put in order than if had paid for proper material and installation in the first instanc Electrical equipment is something that does not lend itself shoddy work if there is to be continual satisfaction. The obvio course is for factory owners, or their advisers, to specify that t equipment must be in accordance with the regulations. If, the the expert inspectors find it does not so accord, the contracto can be called upon to put it in order at their own expense. Th is the only way to break down the evasion of the regulation The report says that two of the Divisional Inspectors have draw attention to the inefficiency of earth connections in many install tions, and they enumerate other dangerous conditions. The ele tricity supply industry ought to set up a campaign against th bad work, which does no good to reputation on the score of safet During the year, it is mentioned, there were four prosecutions f breach of the regulations; and penalties of £5, £10, and £50 we imposed in three instances. One case was dismissed on technic (legal) grounds.

Accidents and Fatalities.

Some of our electrical critics have t bad habit of girding at the gas indust on the point of risks attaching to it, fo getful that their own industry is full testimony of dangers to life and property. These critics are of t class of myopes who used to squeak out, with monotonous reg larity, "Gas must go," and who are now having it forced up their dull imaginations that, if gas had gone, the Kaiser would this time have been lord of the greater part of Europe and t British Isles. It is a war of high explosives; and the country h not the high explosives at the beginning of the war, while Germa had, and nearly reached Paris in consequence. Over 600 plants in this country (and the number is increasing) are c bonizing coal and rescuing every minute of the twenty-four ho the necessary ingredients for these high explosives. The el trical myopes are silent, and nothing can now stir them to re-ut their fatuous phrases as to the extinction of gas. The same w the dangers of gas. They decline to treat of them comparativ with electricity. Mr. Scott Ram's report annually supplies th with some melancholy data—data which prove how essential his special department. He reports that last year the number electrical accidents in generating stations providing supplies public service and for electric railways and tramways was of which three were fatal, and at other stations there were 34, which one was fatal. The total number of accidents—99—c pares with 94 the previous year, and the fatalities four agai three. In factories, there were 350 electrical accidents, of wh 16 were fatal. Now where in other parts of the Home Of report can electrical critics find the equivalent of these figu referring to the use of gas in factories and workshops? In lysis of the total electricity accidents, it is observed that 65— highest number—were due to portable apparatus, conductors, flexible wires; 26 arising from the handling of flexible wires. ere is one happy feature, and that is the number of accidents ess by 68 and the fatalities by one than in the previous year. causes of the accidents were varied. Short-circuits, shock, ngs were among them. Unearthed portable drills and lamps tributed to the shocks. Altogether (as is seen from the fore- g) twenty cases of fatalities are recorded. Five of these were igh voltages; fifteen at lower ones. Mr. Scott Ram gives the obable" voltages, in the case of the fifteen deaths, as follows: fatality was at 290 volts; one at 265 volts; two at 440 volts; en at 250 volts; one at 400 volts; one at 230 volts; one at volts; and one at 200 volts. The fatalities were all due to ck from alternating current. These accidents and fatalities not include all that occurred from electrical causes during ; they are only the ones that came within the cognizance of Chief Electrical Inspector's Department.

Asylum Tenders. In a previous paragraph, reference is made to cheapness and inferior installation work. Some electrical installation k does not appear to be cheap. There has just been pub- ed a list of twenty-one tenders for the electrical installation he Park Prowett Asylum for the Hampshire Joint Asylums mittee. The figures look as though they might be for the struction of the buildings for an asylum, instead of for merely electrical installation. The lowest of the tenders is £15,480, the highest £22,855—a difference of no less than £7375! It at not to be difficult to find the first inmates for the asylum, these tenderers are offering on the same specification, and plying with it in all details.

operative Publicity. Subscribers to the British Commercial Gas Association will be interested in a little co-operative incident in Bradford. electricity supply industry has not an organized publicity me in operation. But what is non-existent in a general way part made up for by spasmodic local effort, which is not by means the same thing as our British Commercial Gas Asso- on. The Bradford Corporation Electricity Department and ocal electrical contractors had recently ("Electrical Indus- " states) a whole page editorial advertising supplement in Yorkshire Observer;" the articles being devoted to electric ing (with special reference to the "half-watt" lamp, which for favour under a false title), and to electric heating. In atter article, the "ideal properties of electric heating" were asized. Is economy in relation to thermal value one of the al properties?" The Electricity Department were financially orted in this effort by lamp makers and the local electrical actors.

Noisy Motor-Generators. Motor-generators seem to be a source of great annoyance. A correspondent of the "Electrical Review" (signing himself "Troubled") says one which worries makes a surging noise all over the building in which it does He has tried to cure it by putting "Masculite" under the but this has no effect. He has tested the rings, and finds running they are completely short-circuited. The set has tested for balance, and has been found quite correct. Other le appear to have had trouble; and out of the letters received e Editors of the "Review," they have published one from D. D. Rayner, of Wolverhampton—the others have been sent "Troubled" for his consolation. Mr. Rayner says he had ilar difficulty with a motor-generator some fifteen months the only difference being that, in his case, the machine had ng bearings instead of ball-bearings. It was required for ying direct current to a cinematograph arc; and, tested actual working conditions, the surging noise was very eable. It was found that the trouble was due to the source pply. In that part of the city, the single-phase current was ied from a reciprocating set. The explanation given by Mr. er is that the magnetic field of the single-phase motor being cillating one against a rotating field in the case of the poly- motor, the reciprocating motion of the engine is super- on this oscillating field, giving rise to the surging phen- a, the resultant period of the superposed oscillation synchro- with the natural period of vibration of the revolving parts. s found that this trouble only occurred at the high speed of to 1400 revolutions per minute. The noise being objection- it was decided to put in a six-pole set, giving a synchronous of 1000 revolutions per minute. When this set was tested , the trouble had entirely disappeared. Mr. Widlake in his on the use of gas-driven generator sets for cinematograph ses had something to say about these troublesome and un- omical motor-generators. ["JOURNAL," Aug. 4, 1914, p. 283].

ce for Electricity Generation. In a letter which appeared, in our "Correspondence" columns last week, from Mr. E. W. L. Nicol on the subject of "Fuel Economy from the National point," there is a case that should appeal particularly to l station engineers. It shows that steam plants at muni- and company controlled electricity generating stations are mong the largest consumers of gas coke, which is sufficiently indicative that loads subject to considerable and sudden variations may be safely dealt with by plants so fired. Considered thermally, the use of coke instead of coal in this way is of national importance; but every station engineer must regard the matter from the financial side in relation to his own station. Mr. Nicol is able to give complete satisfaction on this head. He says the relative cost of evaporation with smokeless Welsh coal and coke, even at the normal difference in price, is invariably in favour of coke; while coke can usually compete successfully in cost with the higher priced bituminous steam coal, and it is smokeless. The maximum rate of combustion, and therefore the greatest steaming capacity, is attained with coke graded to pass through a 2-inch square mesh screen, and over a ¼-inch screen of similar section. Experiments by the London Coke Committee and various boiler makers show that 1 lb. of average gas coke, suitably graded, will evaporate the equivalent of 10 lbs. of water from and at 212° Fahr. There are other instructive particulars given, as well as information regarding coke breeze. In the concluding paragraph, Mr. Nicol explains that the relatively high evaporative value of gas coke as compared with bituminous coal of the same or greater heat value is to some extent due to the very small proportion of hydrogen contained in the former (about 0·5 per cent.) and its comparatively high radiant efficiency.

SULPHURIC ACID MANUFACTURE.

A Proposed New Method.

THE Consul-General at Chicago, states the "Board of Trade Journal," reports that a new method of manufacturing sulphuric acid is suggested in a United States Department of Agriculture Bulletin entitled the "Production of Sulphuric Acid and a Proposed New Method of Manufacture."

The essential difference between the present method and the proposed new method is stated to be that in the latter the gases employed are drawn downward through a spiral flue, in place of being drawn through lead chambers or intermediate towers. It is asserted that the resistance of gases to the downward pull, and the constant change in their course through the spiral, tend to mix them very intimately. The fact that the gases constantly impinge on the walls of the spiral flue, which can be cooled either by air or water, makes it practicable to maintain the gases at a temperature most favourable for efficient yield of sulphuric acid. In laboratory tests in which the spiral was utilized, practically all the sulphur dioxide was oxidized to sulphuric acid; only traces being lost through escape or in the system. The lead spiral, however, is not intended to replace the Glover tower, or to do away with the Gay-Lussac tower. It is believed that while the lead spiral will take considerable lead, the great reduction it will effect in the chamber space will make it possible to construct a plant with considerably less lead than is required in the ordinary chamber system.

The new type of plant requires no other device to accelerate the reactions, occupies much less ground space, and would not need such large buildings, and therefore should decrease the initial cost of construction. The method, however, has only been tried on a laboratory scale. The Bulletin does not, it is added, predict just how efficient the commercial plant would be, but it states that all indications are that this method offers promise of being economically successful.

PERSONAL.

After having ably filled the office of Secretary to the Bristo Water Company for upwards of forty-six years, Mr. A. J. ALEXANDER has resigned, and been appointed to a seat on the Board. In this way, the shareholders and the citizens will not lose the benefit of those services which, in his capacity of Secretary and General Manager of the Company, have proved of such great value in the past. Mr. WILLIAM A. D. ALEXANDER has been appointed to succeed him as Secretary.

OBITUARY.

At Seraing, Belgium, on the 20th inst., the death occurred of Mr. ADOLPHE GREINER, D.Sc., the Director-General of the John Cockerill Company, and President of the Iron and Steel Institute. A note on "Heating an Open Hearth Furnace by Tar," presented by him to the Institute, appeared in the "JOURNAL" for May 18 last [p. 401]. Deceased was responsible for the introduction into the Cockerill works of the basic process of steel making and the utilization of blast-furnace and coke-oven gas. He was elected President of the Iron and Steel Institute in May, 1914, having been, for many years, a member of the Council and Vice-President. In 1913 he was awarded the "Bessemer" gold medal. At the Leeds meeting of the Institute in 1912, the University of Leeds conferred upon him the honorary degree of Doctor of Science.

A CRITICAL REVIEW OF THE METHOD EMPLOYED FOR DETERMINING HEATS OF COMBUSTION.

By Stanley Robson, M.Sc. (1851 Exhibition Scholar of the Armstrong College, Newcastle-on-Tyne), Research Student in the Department of Chemical Technology, the Imperial College of Science and Technology, London.

(*Continued from p. 432.*)

III.—Favre and Silbermann (1852).

The work of Favre and Silbermann was carried out some ten years after that of Andrews. Their methods for the prevention of radiation, and for the evaluation of the losses and gains of heat from the surrounding air, are very elaborate, and their original publication [See "Annales de Chimie et de Physique;" Series 3; Tome XXXIV., p. 357] is well worth careful perusal.

Fig. III. gives diagrams of the whole of the apparatus that was used by them.

The calorimeter *a a* fig. 1 was made of copper, plated externally with silver, which was highly polished to diminish emissivity. The lip around the top was also silver plated and contained water. The lid *a′ a′* completely covered *a a*, and carried a projecting ring which fitted tightly into the calorimeter. The jacket *d d* was also of copper, and was silver plated and highly polished on the internal face. The space between *a a* and *d d* (about 20 m.m. across) was filled with swansdown. The jacket *d d* was enclosed in the vessel *e e*, filled with water, and rested on cork supports *e′ e′*. The calorimeter was likewise supported on corks resting on the bottom of the vessel *d d*. To minimize radiation from the cover, this was made of cardboard lined with swansdown. Finally, the whole system was supported on wood resting on metal, as shown in fig. 6.

The combustion chamber was of thin copper, fig. 3, and had a screw cover containing three outlets: O, to admit oxygen for the combustion. S, to receive the end of the spiral condenser which could be stoppered if not needed, but was always kept in position so as not to alter the mass of the apparatus. A, which received various vessels containing the substance to be burnt.

As these substances were more or less volatile, from 2 to 3 grammes of water were put between the containing vessel and A, in order to communicate rapidly the heat to the mass of water in the calorimeter. The stopper B was so made that the vessels containing the substance to be burnt could be suspended from it. The tube *m* was for manipulating the stopper. Its lower end was closed by a compound disc made of quartz, glass, and alum; and by means of a suitably placed mirror M the combustion could be watched while in progress. *m* received the pipe conveying the jet of hydrogen or oxygen as required by the experiment. The thermometers, which were carefully calibrated, carried 32° starting from zero—each degree being 8 mm. long.

The reservoir during an experiment was situated at the level of the top of the combustion chamber. The temperature of the water in the surrounding vessel was also noted, and was kept as near as possible to that of the surrounding air. The readings were made by means of the cathetometer K (fig. 7), which was read to $\frac{1}{100}$ mm. Wherever possible, the weights of the products of combustion were taken as a measure of the amount of substance burnt.

Fig. 7 shows the apparatus completely assembled. The oxygen for the combustion was prepared in O, received in R, and carried through the safety tube *b′* into the gasometer regulator *g*. The bottle *b* containing concentrated sulphuric acid and the U-tubes *t* containing fused caustic potash and pumice impregnated with concentrated sulphuric acid served to purify the gas previous to its admission to the combustion chamber. If a gas were to be examined, it was collected and purified in a similar way. [Fig. 10 only, however, indicates the gasometer regulator.] When it was not desired to store the gas over water, it was collected in a leather bag held in a press, as shown in fig. 9. This device was substituted for a mercury gasholder owing to the excessive price of that element.

The products of the combustion were led through the absorption apparatus 1, 2, 3, 4, where water and carbon dioxide were retained. Any partially oxidized products—such as carbon monoxide—were completely oxidized by passage through a heated tube containing copper oxide (5), and the carbon dioxide thus formed was absorbed in the apparatus 6, 7, 8, 9. The residual gas was collected in the glass jar P, and subsequently analyzed. From these data, an accurate correction could be applied for any incomplete combustion which might occur.

Favre and Silbermann's correction for loss or gain of heat by radiation during the course of an experiment depended on the division of the total time into arbitrary periods, during each of which the combustion might be said to be regular. The mean value of each period was taken, and the algebraic sum of these gave the total correction.

The loss or gain of heat per degree difference between the calorimeter *a a* and the jacket *e e* was found by making a separate experiment in the following manner: The calorimeter was filled with water 8° C. below the temperature of the surrounding air, which was in equilibrium with the temperature of the water in *e e*, and the gain of heat per minute observed. This was found to be 0·002° per minute for every degree difference between the water in *a a* and that in *e e*; and this rate was constant even over such a long period as one hour.

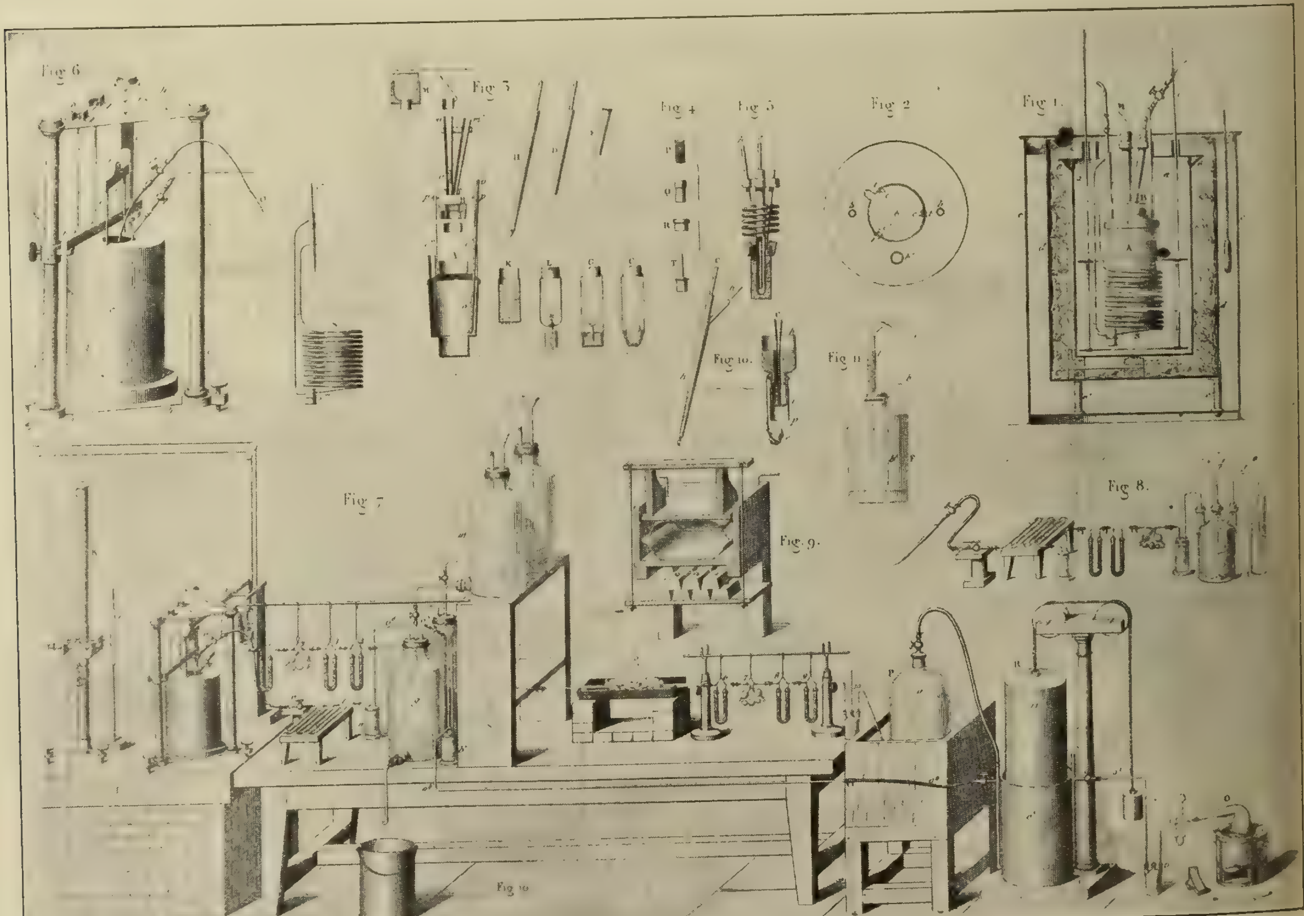


FIG. III.—THE APPARATUS USED BY FAVRE AND SILBERMANN FOR DETERMINING THE HEATS OF COMBUSTION.

The following description of an experiment to determine the heat of combustion of wood charcoal will serve to make clear their method of correction for both incomplete combustion and temperature measurement.

Heats of Combustion of Different Varieties of Carbon.

(I). *Wood Charcoal.*—The carbon obtained from wood by calcination was heated successively in currents of chlorine, hydrogen, and nitrogen. It was burnt in a furnace K, which is a thin cylinder of platinum, 50 mm. long and 17 mm. diameter, with a bottom pierced by several holes to serve as a grate. O (fig. 3) was stoppered; the oxygen for the combustion being fed through D. After filling the chamber with oxygen, D was withdrawn, and a small piece (4 to 5 mg.) of red-hot carbon was dropped through *m*, and D was quickly replaced. The course of the combustion was watched through *m*. The following are the experimental details :—

Time (Mins.).		Cathetometer (mm.).	Correction of T.
0		115·77	A—Heating for 1·17 mins. from 11°·87 towards 15° (temperature of the air) = 0·002 × 3°·13 × 1·17 = 0°·00732 (negative correction)
5		116·02	
10		116·29	
12	A	116·42	
13·16		117·52	B—Heating for 5 mins. from 12° towards 15° = 3° × 0·5 × 0·002 = 0° 0300. Mean = 0°·0150 (negative correction)
14·83	B	(fired)	
16·53		..	
18·17		..	
19 83	B^1	..	B^1—Cooling for 6·58 mins. from 19° towards 15° = 0·002 × 4° × 6·58 = 0°·02653. Mean = 0°·02665 (positive correction)
21·42		..	
23 17		..	
24·75	A^1	182·42	A^1—Cooling for 2·25 mins. from 19°·5 towards 15° = 0·002 × 2·25 × 4°·5=0·02051 (positive correction)
27·00		..	
28·00	D	186·90 .	
30·00		..	
35·00		186·45	D—Cooling for 3 mins. from 20·55° towards 15° = 0°·03363 (positive correction)
40·00		185·97	
45·00		185·50	

Therefore temperature correction = 0 05847 positive.

Weight of CO_2 absorbed from the direct combustion of carbon	7·895 grams.
Weight of CO_2 absorbed from the combustion (subsequent) of CO.	1·128 ,,
Therefore total weight CO_2 formed . . .	9·023 grams.
Initial temperature of the calorimeter	11·8658°C.
Final ,, ,, ,, ...	20·5478°C.
Elevation of temperature of bath	8·6820°C.
Correction (from above)	0·05847°C.
Therefore true temperature rise. . . .	8·74047°C.
Weight of water in the bath and water equivalent of the apparatus.	2079 grams.
Therefore total units of heat recorded . .	18175·1 cals.
Units of heat due to the combustion of CO formed (calculated from their values for the heat of combustion of CO)	1724·7 cals.
True total units of heat	19899 8 cals.
The weight of carbon burnt	2·4608 grams.
Therefore the combustion of one gramme of wood charcoal yields	8086·7 cals.

The method of procedure was varied slightly from that which s described above, according to the nature of the substance under nvestigation.

Hydrogen was burnt in the combustion chamber with the condenser shut off; and the amount burnt was estimated from the ncrease in the weight of the vessel after a correction had been nade for the substitution of moist oxygen for dry air and for the hange in effective volume due to condensation of the water.

Hydrocarbons.—These were analyzed previous to the experinents; any excess of hydrogen over the theoretical being considered free hydrogen. The amount burnt was estimated from he amount of carbon dioxide produced, after allowance had been nade for the very small amount of carbon monoxide formed.

Carbon Disulphide.—This was weighed in an open vessel and a orrection for evaporation during its conveyance to the combusion vessel applied from experiment into its rate of evaporation nade at the time of the calorimetric experiment. In order to btain complete combustion of the carbon monoxide in experinents on this gas, it was diluted with one-third of its volume of ydrogen.

It has been customary in technical work to use some of the alues obtained by Favre and Silbermann. It is, therefore, important that a critical examination of the heats of combustion obained by them should be made. Such an examination will lead o the conviction that while the investigations of these workers vere carried out with a completeness and care unusual in similar nvestigations of that period, their results cannot be considered s the most accurate determinations now available of the heats f combustion of the substances they examined—more especially n view of the later work of Thomsen and Berthelot. In particular, Favre and Silbermann's method of ignition of solids was rude; also some of their corrections for incomplete combustion re open to question.

A case in point is their value for the heat of combustion of arbon, which is of fundamental importance, inasmuch as the value 8080 calories for the heat of combustion of 1 gram. of charcoal has since been universally used in scientific and technical calculations. It should be mentioned, moreover, that Julius Thomsen used it in his calculations of the heats of formation of hydrocarbons.

In the foregoing account it has been shown that in the example quoted in detail, the correction for incomplete combustion is very large—7·895 grams of CO_2 being obtained from the direct combustion of the carbon, and as much as 1·128 grams of CO_2 being formed from the CO which, of course, represents incompletely burnt carbon. This fact alone is sufficient to throw doubt on the accuracy of the determination because an experimental procedure which admits of so much incomplete combustion can hardly be accepted as satisfactory to-day. Moreover, reference to collected results of these workers shows that the value of the heat of combustion of CO was obtained from two experiments only, the results of which differed by 1·1 per cent. of the total heat; so the error due to the introduction of this correction may be 0·14 per cent. of the total heat of combustion. A further matter for serious criticism is the quality of the gases they employed in their researches. The hydrogen, for example, was undoubtedly contaminated with hydrocarbons; and their hydrocarbons were admittedly contaminated with hydrogen. Such impurities involved errors the magnitude of which would be difficult to estimate, and allow for, in their experiments; and it seems doubtful whether their published heats of combustion for other gases can be accepted to-day as sufficiently accurate.

In the matter of temperature correction for loss and gain of heat due to radiation and evaporation, their method as already fully described, can be considered as perfectly sound. The thermometer readings could, however, by no means be so accurate as the measurements of the mercury level would suggest (which is indeed 1-800th of a degree), as the calibration of the instrument was by no means exhaustive. And after perusal of the details of their work it seems probable that no greater accuracy than 1-100th of a degree can be credited to the temperature measurements. In view, however, of the large temperature rise—namely, about 8° C. in the case of carbon—the error due to thermometer reading was not so large as that of many other workers.

EXPERIMENTAL RESULTS.

The following are the heats of combustion (gross) in calories per gram of substance burnt :

Carbon.

Wood Charcoal.	Sugar Charcoal.	Gas Carbon.	Furnace Graphite.	Natural Graphite.
8089·0	8035·1	8037·0	7791·1	7796·3
8074·0	8044·5	8057·6	7783·9	7826·7
8089·0				
8072·0	8039·8	8047·3	7787·5	7811·5
8070·0				
8087·0			7736·1	7774·1
			7738·2	7789·3
8080·1				
			7737·1	7781·7

Sulphur.

Plastic.	Rhombic.	Native.
2253·2	2226·7	2233·8
2262·0	2224·9	2208·0
2258·8		
2259·8	2225·8	2220·9
2258·4		

Gases.	Method of Preparation and Purification.	Values.	
Hydrogen	Prepared from distilled zinc and purified by passage through caustic potash solution; gold chloride solution; concentrated sulphuric acid; fused caustic potash	34,540	34,462
		34,413	
		34,461	
		34,576	
		34,340	
		34,443	
Methane	Prepared from crystallized sodium acetate and baryta. Purification not given	13,030·6	13,063·0
		13,077·1	
		13,081·3	
Ethylene	Prepared from sulphuric acid and alcohol. Purified by passage through cold concentrated sulphuric acid; caustic potash solution; alcohol and water	11,855·5	11,857·8
		11,860·0	
Carbon monoxide	Method of preparation and purification not given	2,388·8	2,402·7
		2,416 6	
Carbon disulphide	Method of preparation and purification not given	3,424·6	3,400·5
		3,376·3	

(*To be continued.*)

Following on the paper read by Mr. B. W. Brooks last Friday, members of the London and Southern Junior Association will next Saturday visit the industrial appliance show-rooms and demonstration workshops of the Gas Light and Coke Company in Goswell Road. On Friday of next week a meeting will be held, at which Mr. W. L. Westbrook, of the North Middlesex Gas Company, will read a paper entitled "Gas *v.* Coal for Domestic Purposes, and the Campaign against the Kitchen Range."

CARE AND MAINTENANCE OF THE "DE BROUWER" RETORT CHARGING AND DISCHARGING PLANT.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

In placing these few notes before the readers of the "Journal," the author would explain that they are intended primarily for the notice of those engineers who have in contemplation the installation of one of the types of "D.B." charging or discharging apparatus; while at the same time he trusts that they may be not without interest to those who already have such plants at work. It is proposed to deal with the three types of machines which, either individually or in combination, go to form a complete charging and discharging equipment for horizontal retorts.

The "D.B." Projector.

As regards the manner in which the charge of coal is placed in the retort which it is desired to fill, this type of machine may well claim to be the simplest, the most efficient, and at the same time the most ingenious of the many devices on the market. In the operation of filling the retort, no part of the machine actually enters the retort; the coal being projected into the setting by the velocity imparted to it upon falling on to a rapidly moving belt carried in a steel frame, and lying in a nearly horizontal plane at a slightly higher elevation than the floor of the retort being charged. The frame, in the case of the earlier machines, was suspended from rails running above the charging floor, and was by means of hand tackle adjusted to its position, both vertically and horizontally, in front of the retort to be filled. Of late years, however, this type has been superseded by a self-contained machine travelling on a ground track on the charging floor; all the operations being (in the majority of installations) electrically performed.

Fig. 1 shows a modern type of "D.B." projector suitable for charging through retorts arranged in three tiers. The machine is fitted with an overhead hopper of three tons capacity, which may be replenished as may be required from time to time from an overhead storage bunker, situated preferably in the centre of the retort-house. The machine itself consists of a steel frame mounted on four running wheels, which are connected through a gear-box to a 7½ B.H.P. compound wound motor bolted to the near sill plate, and actuated from the rear control platform by a tramway type controller. The four wheels run on an ordinary tramway track laid in front of the retorts.

The actual charging mechanism consists of an inner steel frame suspended within the outer frame of the machine, and fitted with a large grooved pulley and three band pulleys, over which latter a broad band runs, passing *en route* over about one-quarter of the periphery of the grooved pulley. One of the band pulleys runs in adjustable bearings carried on sliding brackets bolted to the inner frame, by which means the proper degree of tension can always be kept on the projector belt to compensate for increased length due to wear. The grooved pulley, which, it will be seen, runs at the same speed as the belt, is usually made about 3 ft. 3 in. diameter. It has a face width of about 15 inches; while the groove is about 8 inches wide by 4 inches deep. The latter dimensions, however, vary with the width of the retort and the class of coal used. Fig. 2 shows diagrammatically the arrangement of these various pulleys, and the run of the belt in relation to the retort to be charged.

The inner frame, as has been observed, is suspended by means of chains within the outer frame of the machine, within which it is free to rise and fall in order to adjust itself to the height of the retort to be charged; the raising and lowering being performed by means of the travelling motor fitted on the sill plate of the machine. The gear-box, through which this is connected to the driving wheels, has a projecting chain drum; and the travelling or elevating motion can be put into action by means of a spring lock hand lever situated near the operator's right hand.

The coal is fed from the measuring chamber or hopper, as the case may be, by means of a telescopic shoot terminating in a tundish or spout, by means of which the coal is conducted into the groove of the large pulley and hence on to the moving band. The spindle of the front band pulley is geared direct to the armature shaft of the driving motor by means of a belt. The projector motor is a 6 B.H.P. shunt wound machine, having a speed variation of from 750 to 1500 revolutions per minute, this variation being obtained by means of a rheostat in the field circuit. It is usually found that a 6½-inch pulley on the armature shaft driving a 13-inch pulley on the front projector spindle gives the best results.

Electrical Arrangements.

The current is collected from the two line or trolley wires by means of collectors of the ordinary street tramway type, but, of course, on a much smaller scale, and passes into a double pole switch *viâ* (on one pole) an electrical cut-off switch operated by a tappet gear, the function of which is to cut off the current should the inner frame be raised or lowered beyond the usual limits. On the machine side of this double-pole switch an automatic circuit breaker is fitted on one pole, and the current is then distributed to the two main circuits of the machine—namely, the projector and the travelling-hoisting motor circuit.

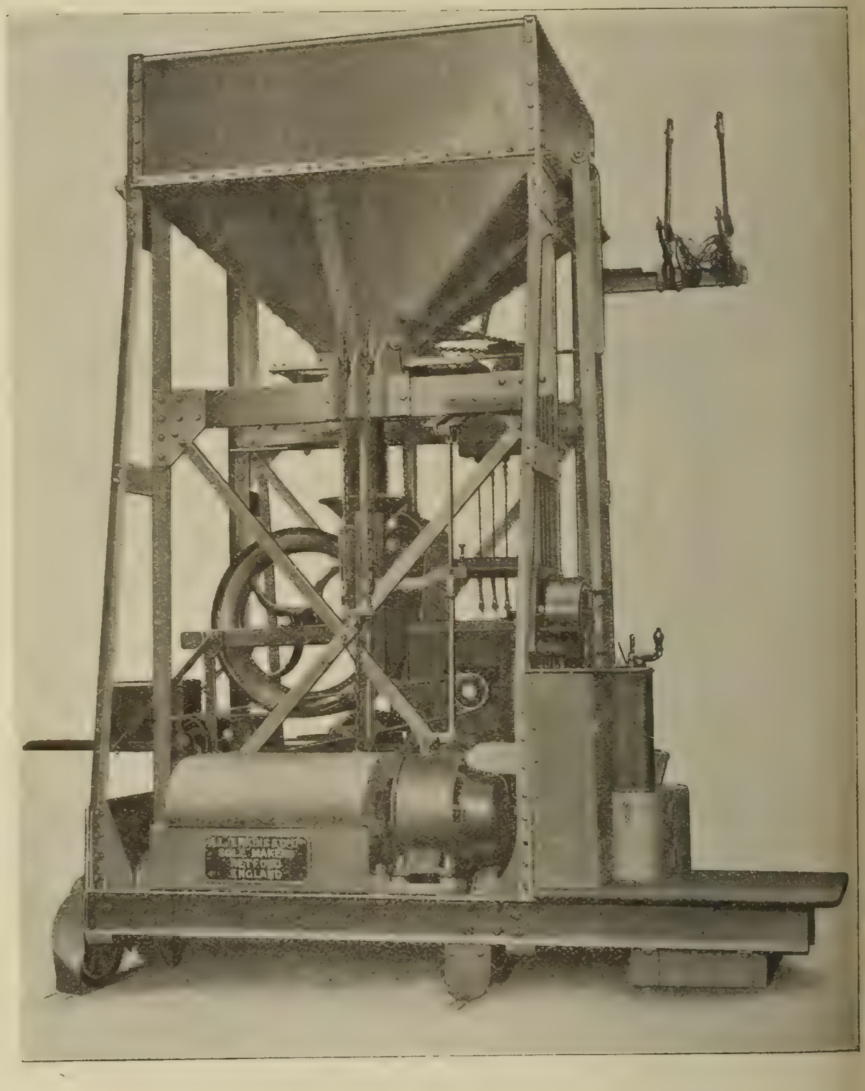


Fig. 1.

The controlling gear for the projector motor is situated immediately in front of the operator, and consists of an ordinary radial arm shunt motor starter and an adjustable rheostat connected in circuit with the shunt field of the projector motor. The starter is fitted with two automatic devices: (1) A no-volt or hold-up coil connected in the field circuit whose function is to release the starter arm in the event of the current failing, and thus permitting it to return to its "off" position by the spring control. (2) An overload cut-out, consisting of a few turns of heavy insulated wire connected in the main circuit and wound upon an iron core, which, when magnetized to a predetermined extent, lifts a small iron armature which short-circuits the hold-up coil above referred to, which, as in the case of a failure of supply, allows the starter arm to return to the off position.

Among other factors, the speed of an electric motor depends upon its field strength and upon the current passing through its armature windings, which latter factor is dependent upon the back or counter electromotive force which the motor, by reason of its dual characteristics with a dynamo, generates in opposition to the incoming or line current. The greater the field strength of the machine the greater this back-pressure will be, and, as a direct consequence, the less will be the current passing through the armature. It thus becomes apparent that by increasing the field strength of an electric motor the slower it will run; while, conversely, the speed will be increased by weakening the field.

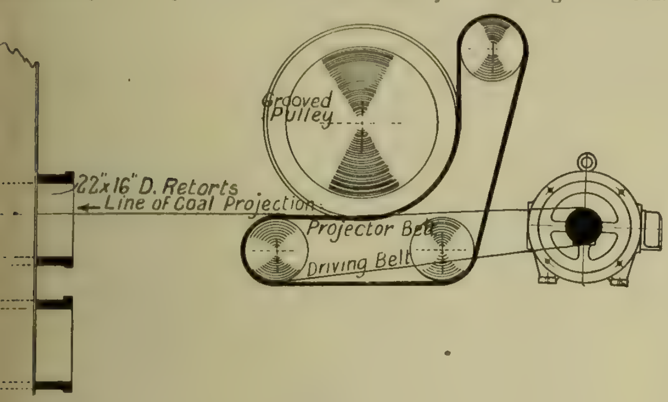


Fig. 2.

t is on this principle that the speed of the "D.B." projector otor is controlled. An adjustable resistance is connected in ircuit with the field windings of this motor, by means of which a arge range of field strength, is obtained, and a correspondingly ide degree of speed regulation.

Fig. 3 shows a diagram of the connections of the projector otor. The projector motor, as has been explained, is fixed on e hanging frame, as is the starting switch; but the regulating heostat is fixed on the outer frame. It will be seen that it is ecessary to provide means whereby three separate connections re taken from the outer fixed frame to the inner adjustable frame –namely, a positive and a negative line wire to the motor and to e starter, and a shunt wire from the motor to the regulating re- istance—in order that the supply of power may be uninterrupted

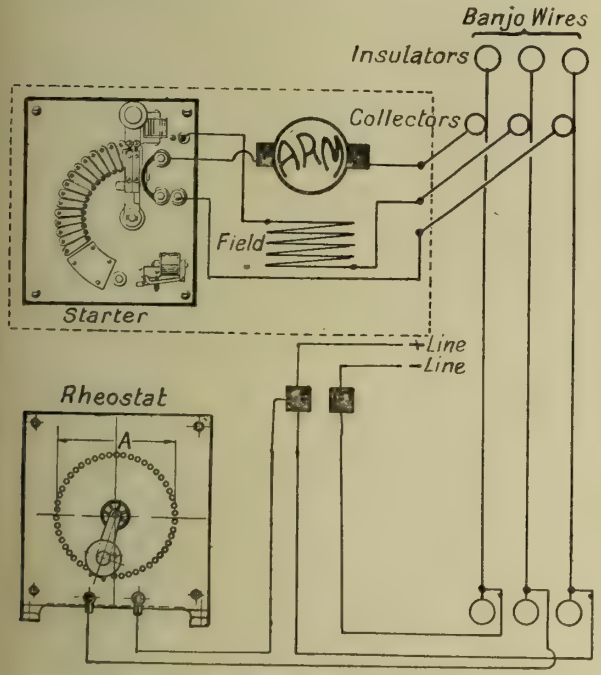


Fig. 3.

all positions of the inner frame, which varies with the particular r of retorts which are being dealt with. In the older types of ectric charging and discharging machines these conditions were et by the use of spring controlled cable drums or other compen- ting gear; but in the case of the "D.B." machine, these connec- ns (shown diagrammatically by three rollers pressing against ree vertical wires) are maintained by means of three banjo wires ained vertically between insulators on the outer frame of the achine and connected to the two feeder wires and to the wire m the field regulator respectively.

On the edge of the inner frame are fitted three spring roller con- cts, which, pressing against the banjo wires, maintain the con- ction during the entire vertical travel of the hanging frame.

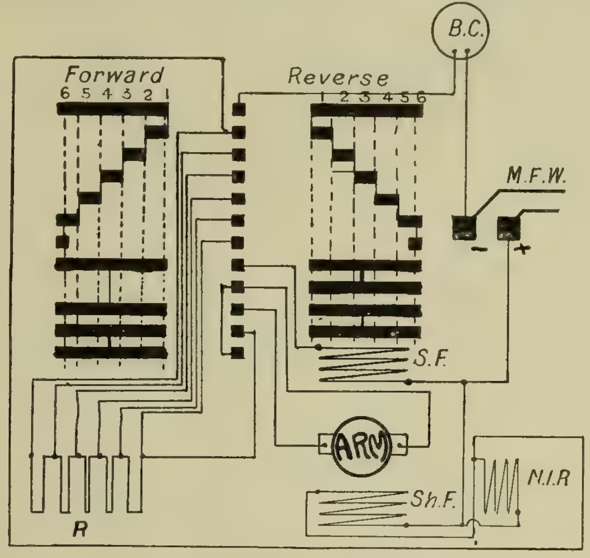
The shunt speed regulator, with which the "D.B." machine is uipped, is a singularly robust piece of apparatus, and is particu- ly well adapted to withstand the heavy duty of continually eeding-up or slowing-down the projector motor. It is fitted th easily renewable contacts and resistance elements, and its sign is very sound, both mechanically and electrically—burn- ts being practically, if not absolutely, unknown.

TRAVELLING MOTOR CIRCUIT.

Fig. 4 shows a wiring diagram of the travelling-hoisting motor- rcuit. The two feeder wires are brought into a controller of the tramway type, into which are also brought the resistance and the motor leads. In connection with this circuit, it will be seen that both motor and control gear are fixed on the outer frame; there being no need for any sliding or other compensating device. The motor itself is a specially designed permanently compounded machine; sufficient shunt windings being added to a series type motor to prevent any undue alteration of speed even under light loads.

An automatic safety gear is fitted to the controller of this motor in order to obviate the possibility of the inner frame being raised or lowered beyond its normal limits. The action of this gear is to bring the controller to its "off" position by mechanical means upon the inner frame reaching the limits of its vertical travel, or to cut-off the current by means of the tappet switch already alluded to when these limit points are reached.

The function of the non-inductive resistance or "kick coil" shown in the diagram is to prevent the dangerous rise of pressure which invariably occurs on opening a highly inductive circuit. The collapse of the magnetic lines of force with which every inch of the thousands of turns of wire which compose a shunt-field coil is surrounded results in what is known as a "transformer effect," and gives rise to a momentary pressure of electromotive force which may be many times greater than the line pressure under which the motor works, and which, if not provided for, may result in serious damage to the insulation of the windings.



R. Resistance. S.F. Series Field. Sh.F. Shunt Field.
Arm. Armature. N.I.R. Non-Inductive Resistance.
B.C. Blow-out Coil.

Fig. 4.

The non-inductive resistance or kick, or "buffer" coil, as it is commonly known, absorbs this current, and by its presence prevents the conditions of open circuit under which alone this momentary E.M.F. can become dangerous.

CHARGING OPERATION.

The opening over the feed roller having been adjusted to suit the class of coal to be used, the projector motor is started by slowly moving the switch over the starting contacts until the arm of the swich is held up by the no-volt magnet. The rheostat in the shunt circuit of the projector motor is now adjusted until the large grooved pulley attains a speed of about 220 revolutions per minute. This gives a very satisfactory belt speed for ordinary broken coal; but variations in the size of the coal require variations in the speed at starting—slower for clean large nuts and coal, faster for small and slack. This speed also varies with the size of the retort and the extent to which it is desired to fill it. With ordinary broken coal and (say) 9 cwt. charges in a 22 in. by 16 in. by 20 ft. retort, the belt speed should be in the neighbourhood of 2300 feet per minute; but if heavier charges have to be put in, a higher speed will be necessary.

The hopper door is then opened, and the coal falls through the telescopic shoot and the tundish into the space between the bottom of the groove on the large pulley and the belt. As both the belt and the pulley are running at a greater speed than the falling coal, the latter, on meeting the belt, will be gradually accelerated in speed. Newton's first law of motion, which asserts the inertia of matter, begins to operate from the moment the coal strikes the belt, when the stream of coal falling vertically from the telescopic shoot comes into contact, nearly longitudinally, with the belt, which latter immediately supplies a deflecting force which tends to deflect the coal out of its vertical course—the principal use of the groove being to prevent the coal from flying about before it comes to rest on the band.

On reaching the end pulley, the belt suddenly changes its course; but the coal continues the motion previously imparted to it by the belt, and is projected in that direction in a straight line and is thus delivered into the retort in a continuous stream like water leaving a hose pipe. This stream of coal is, of course, under the influence of the law of gravity, which tends to bend it downwards until the coal comes into contact with the bottom of the retort. At this point, however, the energy in the projected stream of coal has by no means been expended, and a stopper is placed at the end of the retort to be charged, which finally arrests the onward flow of the coal, the remaining energy in which is expended in lifting itself to a certain height, thus giving thickness to the layer.

So long as the initial speed and the sliding friction encountered remain the same, the layer will be of even thickness. It will, however, be seen that as the retort becomes gradually filled the length over which the particles of coal have to slide will gradually diminish; and if no change in speed of projection were made, the result would be a layer of coal thickening-up from the far end to the mouthpiece nearest the machine. This tendency is counteracted by gradually diminishing the speed of projection, and so reducing the initial velocity of the coal as the charge is placed in the retort.

It is a good plan to have the layer of coal slightly thicker in the middle of the retort than at the ends. This is accomplished by leaving the speed of the belt unaltered until nearly half the charge is put in, and then slowing-down the motor as the charge approaches the mouthpiece. Incidentally there is no reason why this slowing-down should not be performed automatically; but this would involve a different setting of the apparatus for each class of coal, while the operation is so simply and easily performed that it may be safely left to the human element. Bad operating in this respect is bound to show when the charge is drawn, and the blame can easily be fixed. The whole operation of charging takes from 20 to 30 seconds, according to the amount of coal put into the retort; and by varying the speed of the belt any desired thickness of charge may be arranged for, or the retorts may be completely filled up if desired.

The following instructions regarding the working of the projector machines will be found to conduce to efficient operation:

> The height of the machine should be so adjusted that the stream of coal leaving the belt should just clear the top of the retort.
>
> If the projector belt is found to be loose, it may be tightened by means of the slide adjusting brackets. In this connection, however, it must be remembered that a very little adjustment makes a great deal of difference.
>
> The leather driving belt may be tightened by slacking-off the four holding-down bolts of the motor and then turning the horizontal adjusting screw in the right direction to tighten up the belt. The holding-down bolts should then be tightened up.
>
> Should the charges after once being right show a tendency to become thin at the side of the bench farthest from the machine, it will very probably be due to the driving belt becoming slack and so preventing the projector belt from attaining the proper speed.
>
> Experience has shown that for moderately thin charges—from (say) 5 to 7 cwt. per through retort—the best results are attained when the time of throwing in the coal is limited to about 25 seconds. Heavier charges can be put in much faster.
>
> In hopper machines the speed of the outflow can be regulated by means of the variable speed feed roller and by the size of the opening over same, which may be adjusted by raising or lowering the baffle-plate, which is fitted with a lever arranged in a convenient position. In weighing machines this regulation is effected by varying the opening of the slide door.

(To be continued.)

Masonic—Evening Star Lodge.

On Wednesday last the meeting of the Evening Star Lodge, No. 1719, was held at the Freemasons' Hall, when, by order of the W.M., masonic mourning was worn in view of the recent death of Bro. Captain Richard B. G. Glover—a very popular member of the Lodge—who was killed in action in France on the 5th inst. At the meeting, the appointment of the W.M. for the year 1916 took place; and Bro. J. F. Wicks, the S.W., was elected. W.Bro. A. E. Broadberry was elected to succeed W.Bro. Arthur Valon as Treasurer of the Lodge.

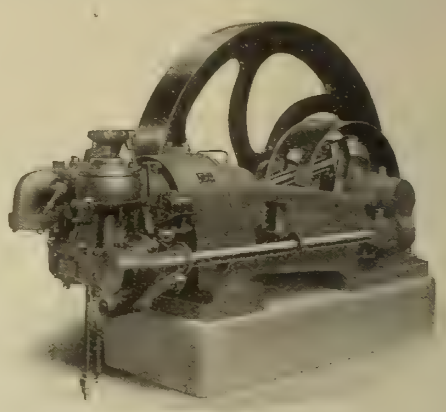
Rittmann Benzol and Toluol Process.—It is announced, says the "Chemical Trade Journal," that the United States Department of the Interior has cancelled a contract with the Ætna Explosives Company, of New York, whereby the Ætna Company agreed to expend a sum of not less than £40,000 in the development of the process, discovered by Dr. W. F. Rittmann, chemical engineer of the Bureau of Mines, for the manufacture of benzol and toluol from petroleum. This action was taken after information had been received from Mr. A. J. Moxham, President of the Ætna Company, to the effect that such encouraging results had been obtained during the period of experimental development of the process as to justify his Company placing a plant on a commercially operative basis. "The cancellation of the contract," it is stated, "is in accordance with the original understanding with the Ætna Company, to the effect that the Government would withdraw from the contract as soon as benzol and toluol were produced in commercial quantities by means of the Rittmann process."

ENGINES OPERATING ON TOWN GAS.

Work of the British Westinghouse Company.

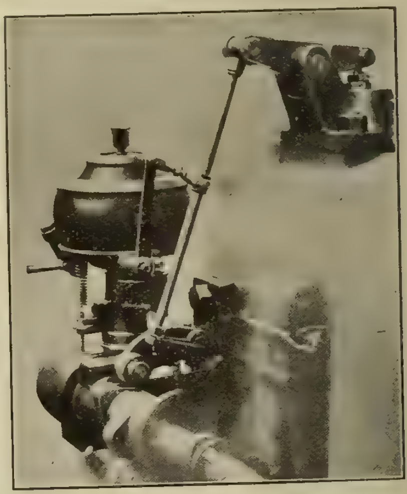
To those who have closely watched the trend of affairs in the town gas engine industry, it has become obvious that engines of this type for power purposes and for generating electricity are coming into their own again; and, further, that the future demand for them promises to be a rapidly increasing one.

What has been done, and what can be done, in the way of utilizing town gas in horizontal engines, is to be gathered from the new "Town Gas Engine Circular" of the British Westinghouse Electric and Manufacturing Company, Limited, of Trafford Park, Manchester, who have, from the time of first commencing to build gas-engines, specialized on town gas. In fact, they show their confidence in the strength of the claims of town gas in this connection in the best possible way—that is, by not manufacturing suction or producer gas plants. In cases where the engines are used for driving dynamos, the Company's position is unique; for as makers of the complete generating plant—engine, dynamo, and switchgear—they assume undivided responsibility, which is a very important factor towards success. The progress already achieved by them in the horizontal town gas engine business is indicated by the large number of their engines now installed in gas-works throughout the kingdom, a few illustrations of which are given here.



Industrial Type (Ranging from 44 to 75 B.H.P. on Town Gas) of Westinghouse Gas-Engine.

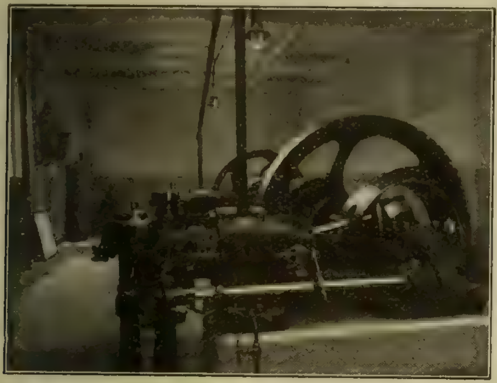
As gas engineers are aware, there are many good reasons for power users installing town gas engines; but, in addition to general considerations, it may be remarked that the Westinghouse engines—which are of British design and workmanship throughout—have been simplified as much as possible, consistent with economical governing arrangements. This will be seen from the illustrated details of design which are to be found in the circular. Particular attention has been paid to the important point of economy in gas consumption; and a useful feature of the circular is a care fully compiled table of consumption and cost of gas per brake horse-power-hour (in pence) for various sized engines operatin on three-quarter load, at prices varying from 10d. to 4s. per 100 cubic feet.



Variable Admission Governor Gear for Westinghouse Horizontal Gas-Engines.

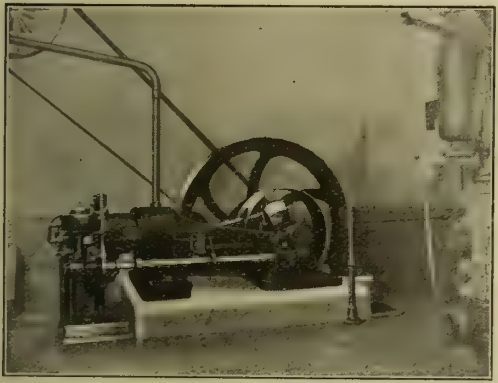
During the past ten years suction gas has been a very seriou competitor to town gas; but apart from the effect now caused b the increased cost of fuel for the gas plant, users realize that th attention required upon a suction gas engine and plant is no quite so small in extent as is sometimes represented. Vaporize troubles occur with suction gas plants, demanding immediate re airs to the boiler or vaporizer, as the suction gas plant may not e worked for long without steam. When such troubles occur, sers realize the advantage of having their engine arranged to vork from either suction or town gas.

Gas managers offer no objection, under agreement, to the uction gas engine being connected-up with town gas as a stand-y; and in course of time it is observed that the consumption of own gas increases, rather than otherwise. The reason is easily xplained, as, apart from using town gas merely as a stand-by en the suction gas is not available, the engine attendant can quently start-up the engine on town gas, and afterwards change-er to suction gas.

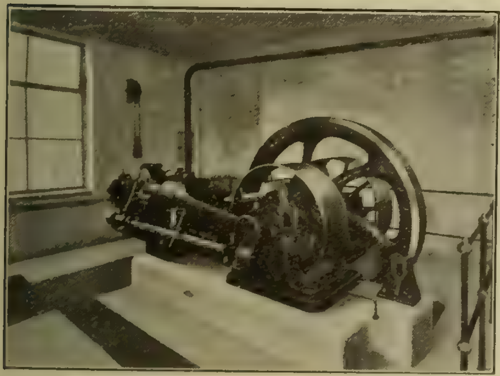


44-B.H.P. Westinghouse Electric Lighting Type Gas-Engines on Town Gas, Direct-Coupled to Electric Generators at the Greenock Gas-Works.

[Three sets supplied through the Woodall-Duckham Vertical Retort and Oven Construction Company.]



35-B.H.P. Westinghouse Industrial Type Gas-Engine on Town Gas, Driving Machinery, Pumps, &c., at the Grimesthorpe Gas-Works, Sheffield.

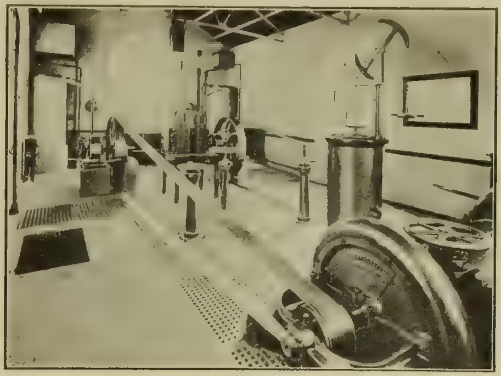


44-B.H.P. Westinghouse Industrial Type Gas-Engine on Town Gas, Driving Coke-Breaking Machinery, &c., at the Hollinwood Gas-Works, Oldham.

·[Supplied through West's Gas Improvement Company.]

It is not disputed that, from the fuel point of view, the suction s engine offers cheaper means of power production than town s, when considering the average cost of anthracite or coke, as mpared with the average cost of town gas throughout the king-m. There are exceptions, however, even to this. For example, ere is the case of Sheffield, where gas is so cheap that only in y special circumstances do people think of installing suction s plants. The point to bear in mind, however, is that fuel and our costs have advanced materially of late years; and this fact, gether with the additional capital outlay involved in a suction s plant, and the extra room and attention required, should cause wer users to-day to decide on a town gas engine.

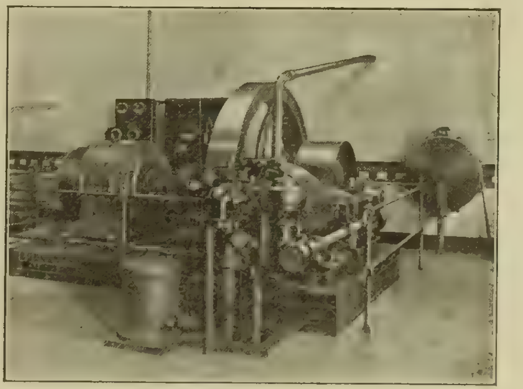
Reliability of the power plant is probably of more importance to manufacturers now than ever before; and shortage of labour due to the war is likely to compel them to adopt a class of prime mover requiring little attention. In this respect, town gas engines rarely, if ever, give any trouble. One reason for this is that the gas is always there "on tap;" another is that, town gas being so comparatively clean, the engine valves require only very little looking after.



6 B.H.P. Westinghouse Industrial Type Gas-Engines on Town Gas, Driving Gas-Compressors by Belt, at the Twickenham Station of the Brentford Gas Company.

[Supplied through the James Keith and Blackman Company.]

A more universal use of town gas engines in the future is based upon sound reasons. As is well known, the incandescent mantle brought into use commercial gas, valuable for its heating rather than for its illuminating qualities. The cost of gas to the consumer, in normal times, has been reduced materially to his advantage. Parliamentary powers to reduce the gas from the unnecessarily high illuminating power standards have been the means of revolutionizing gas making, and increasing the amount of gas obtained per ton of coal. The future points to further development on these lines, and the substitution of the calorific standard for the illuminating power one. Paradoxical as it may seem, the fact remains that reducing the luminous value of town gas has enormously assisted the gas-engine makers in providing a more economical type of engine. The old standard gas, which included a greater proportion of heavy hydrocarbons, prevented the use of even moderately high compression within the cylinder. Nowadays, however, a compression of 110 to 120 lbs. per square inch can be used with perfect safety; and this is the means of developing greater power from the same size of cylinder, at a considerably reduced gas consumption per brake-horse-power-hour.



52-B.H.P. Westinghouse Electric Lighting Type Gas-Engine, with Direct-Coupled Electric Generator, at the Southport Gas-Works.

Electric ignition has further assisted more economical working than was possible with the old tube ignition. This is specially the case when firing weak mixtures—which, by the way, under a system of reliable ignition contribute towards economy. In other words, excess of air within the cylinder is necessary to ensure complete combustion, and to avoid waste of power if unburnt gas passes away into the exhaust-pipe. Tube ignition is now only used upon very small types of gas-engines, and then purely upon the score of cheapness.

Natural Gas in the United States.—Of the record-breaking production of natural gas credited to 1914 (as referred to in the "JOURNAL" last week, p. 447), it is estimated that a total of over 203,104 million cubic feet, or about 34 per cent., was supplied to domestic consumers at an average price of 28·04 c. per 1000 cubic feet, and that 388,762 million feet (the remaining 66 per cent.) was supplied to industrial consumers at an average price of 9·56 c. During the last four years the ratio of domestic to industrial consumption has varied but slightly. Formerly, however, a relatively greater proportion of the annual yield was being supplied to industrial consumers.

THE APPLICATION OF GAS TO INDUSTRIAL PURPOSES.

By B. W. Brooks, Special Representative of the Gas Light and Coke Company.

[A Paper read before the London and Southern District Junior Gas Association, Nov. 26.]

The papers which have been read in recent years on the development of gas appliances for industrial purposes have usually dealt with the scientific side of the subject. I propose to depart from this practice, and endeavour to treat the question more from a practical and salesman's point of view.

A Wide Field for Development.

Each year the effort for an increased volume of business becomes more determined; and with this demand constantly being made, it has been necessary to seek and develop new uses for the commodity we are selling. I therefore think the present moment a very appropriate one in which to talk of the possibilities that exist for the use of gas for manufacturing purposes. It must, of course, be admitted that there are many people who are still prejudiced against the use of gas, and continue to use old-fashioned methods; but I am convinced that we have before us a fine field on which to exert our energies. In order to educate the manufacturing interests in the matters of economy and convenience, the Company I have the honour to serve have recently opened, at their City office, an industrial gas appliance laboratory. Here are installed a fine selection of furnaces, which customers are invited to inspect; and they are also given facilities to witness tests carried out as near as possible to factory conditions.

The Salesman.

A salesman, in the ordinary way, is a person capable of creating a desire within another person to become possessed of a certain article. In this instance, he has to be possessed of other qualifications—chiefly constructive ability. It is essential that the representative should be competent, not only to discuss the requirements of the various trades, but be able to prove, by practical demonstrations, the suitability of the appliance he is recommending. This, of course, means that the technicalities of each trade must be carefully studied; and in many cases it will be found necessary to conduct experiments to determine the most suitable manner in which gas can be applied. Information obtained in this way enables one to approach manufacturers, and place propositions before them with every confidence; and it is surprising how willing they are to listen when you have something tangible to talk about.

In many cases, it will be found necessary to supply a complete specification and drawing of the proposed installation, as matters of this kind usually have to be submitted to the heads of the firms after having been approved of by the works' manager. A nicely prepared drawing, with a detailed description of the appliances, prevents the possibility of misapprehension, and helps to bring the business to an early issue.

Annealing.

I will now endeavour to interest you by describing, with the assistance of drawings, the application of gas to certain trades. I will deal first with annealing, as it is now generally admitted that gas-furnaces are eminently suited for this process. The object of annealing steel (and other metals) is to soften and render it more ductile, in order that it may be machined at the minimum cost of labour and tools. Annealing also disposes of the internal strain and brittleness which is set up in hammering, rolling, and finishing. It brings the steel to a uniform and regular condition, so that when heated for hardening equal expansion is obtained, also equal contraction when cooled. For this purpose, a twin-oven furnace is preferable; the top oven being used for preheating the articles gently before subjecting them to the full annealing temperature in the lower oven. For high-class work, such as cutters and turning tools, a muffle furnace is usually employed, which reduces the chances of oxidizing or scaling to a minimum. If the work has been machined, it is advisable to place the articles in a box packed with powdered charcoal.

Hardening.

The hardening and tempering of a piece of steel can only be carried out by skilful operators; but the operation is made much easier by using a gas-furnace, as it can be worked at a pre-determined temperature. The quantity and variety of tools and other steel articles that are made are so numerous that it is not possible to give a detailed description of the rules and methods employed for this purpose. The object of the process of hardening is to produce and fix the maximum hardness which any given steel is capable of possessing. All steel is brought to its highest state of hardness by being heated to a certain temperature and then being rapidly cooled in such fluids as are most suitable for the kind of steel and the work it has to do.

Salt-Bath Furnace.

Salt-bath furnaces are considered by some people as being the most perfect means of heating steel, especially high-speed steel, for hardening and tempering. The furnace is of the crucible type; the iron pot being sealed to prevent the entrance of the furnace gases. Fusible salts, such as barium chloride or sodium chloride, are heated to a precise and maintained temperature. For hardening, the high-speed steel is put into the crucible until it is of the same temperature as the molten salts, and then it is removed and quenched. Afterwards, any adhering chloride is brushed off, and the work is found to be as clean and of the same colour as before treatment.

Case-Hardening.

This is a method of converting mild steel which will not harden direct, into a steel which will harden "glass hard" on the surface when quenched-off in the water, leaving a soft core in the centre of the bar. Gas is an ideal fuel for this purpose; the process being a lengthy one lasting three to five hours, and requiring a maintained temperature of from 900° to 1000° C. Metal treated in this way is very suitable for making the working parts of motor-cars, such as gears, &c., which are required to have a perfect hard surface and yet be of such a nature that there is little chance of their breaking in use.

Tempering.

The object of tempering is to reduce the degree of brittleness brought about by the process of hardening. The steel is re-heated to a moderate temperature and then cooled off by exposing to the air or by quenching to the degree of hardness required, either in a bath of water, oil, or molten lead.

Brazing Forges.

For many years, brazing has been done on a hearth with the ordinary hand blow-pipe; and while it is possible in most cases to get good results, it leaves room for improvements to be made, so that work which is still being done on the coke-forge can be handled as efficiently with gas. Some makers have endeavoured to specialize in this direction; but there are still many openings for improvement.

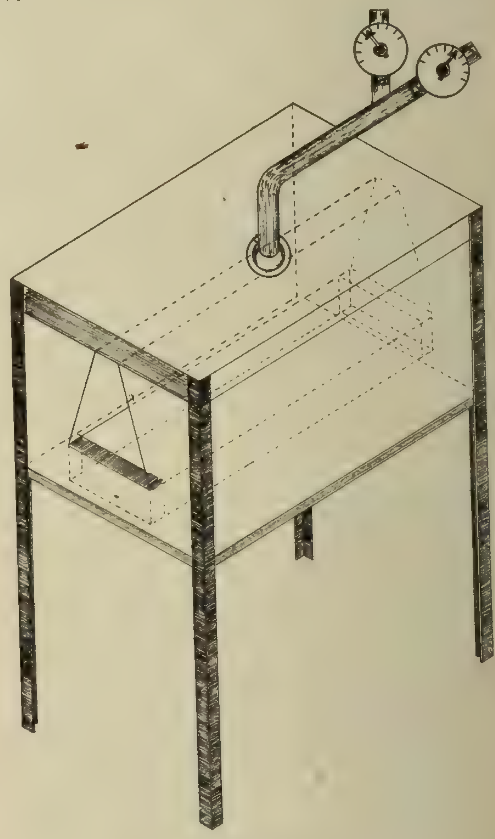


Fig. 1.—Brazing Forge.

Fig. 1 shows a new type of forge that was recently designed for brazing the breech portions of rifles. It does the work in less time than the coke forge, produces a better joint, and a cleaner finish. These forges are also suitable for straightening shafting and forging high-speed steel tools, &c. Other gas-heated forges have been designed, with satisfactory results, for making horse shoes. Two firms in London are, by the aid of these forges, now making 10,000 horse shoes per week for the Government.

Preheating Motor Tyres.

The solid rubber tyres used on motor vehicles, such as omni buses, lorries, &c., are mounted upon iron tyres which fit on to the wheels proper. These iron tyres are turned cold between rollers and then welded, either electrically or with an acetylene blow pipe. When acetylene is used, coal gas can be employed with advantage for pre-heating the work.

Fig. 2 shows a furnace which is most suitable for this specia purpose. It is designed to heat the part which is to be welded to a high temperature before employing the acetylene. A 9-inch tyre, ½ inch thick, can be heated to about 2000° Fahr. from a cold furnace in twelve minutes. After the tyre has been welded, it i necessary to perfect its shape. The whole of it is heated in

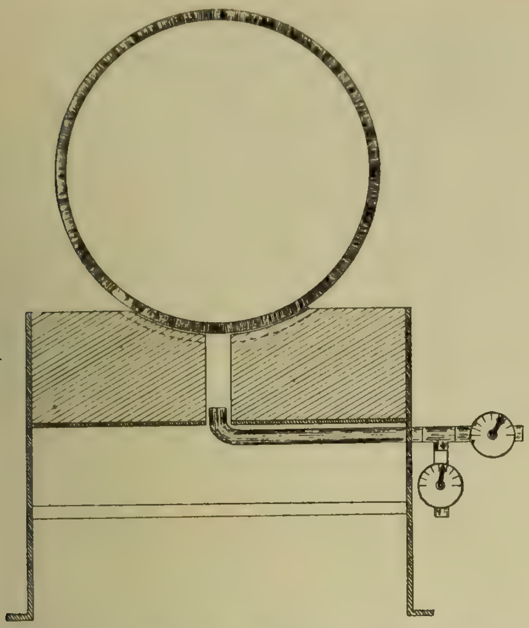


Fig. 2.—Furnace for Preheating Motor Tyres prior to Welding.

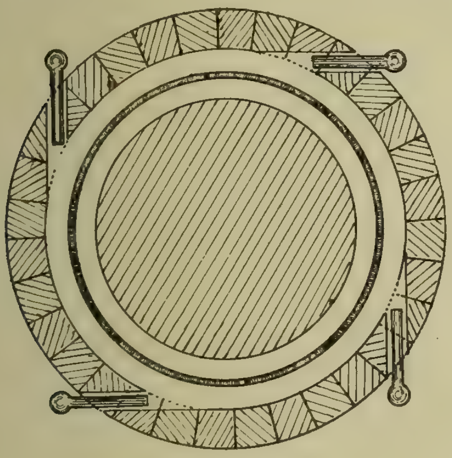


Fig. 3.—Tyre-Expanding Furnace.

rge oven and then finished off. Fig. 3 shows a furnace suitable : this purpose, also for expanding and shrinking tyres.

Enamelling.

There are three kinds of enamel in general use: (1) Enamels for etals (used for gold, silver, copper, brass, or iron, (2) enamels : glass, (3) enamels or glazes for earthenware. For the enamel g of metals for decorative purposes, such as badges, jewellery, ., a muffle furnace gives excellent results. As the work is pro cted from the flame; so discoloration cannot take place. More er, the temperature can be controlled to such a nicety that the ost delicate work can be handled. The proper firing of enamel the muffle is a matter of practical experience. No particular les can be given, except that the heat should be high enough— out 1500° Fahr. At this temperature the firing will take about o minutes, and the enamel should possess a brilliant surface en drawn from the oven. Gas-furnaces can also be used for all factory enamelling work; but for the large and cheap work, s at present cannot compete with coke.

Glass Trade.

Gas-furnaces, called "Glory Holes," are now being used for eating glass to keep it in a plastic condition while the glass ower is shaping the article. The furnaces are most suitable for ishing the necks of bottles and other small work. Ovens (some nes called Lehrs) of considerable length are also used for cooling wn the articles after the glass-blower has finished with them. e front portion of the furnace is heated to a faint red, equal about 1000° Fahr., by means of natural draught burners, and remaining portion is heated by the travelling gases which haust at the end. In this way a graduated heat, suitable for nealing, is obtained.

The articles are put in the warm part of the furnace, and are awn through to the other end—the time of travel depending on the class of work. For high-class stained-glass work, gas ns are used for burning the colour into the glass. In some ses special iron muffles with iron runners cast on the sides for pporting the trays are used, and in other cases the trays are aced on trolleys and wheeled into the oven. Fig. 4 shows the ual type of furnace for firing names on bottles and bending eets of glass.

Stereo Metal Melting.

A large percentage of printers and manufacturers of type-casting machines now realize that gas is the ideal fuel for this purpose. Stereo metal is a mixture of lead, tin, and antimony, and is fairly expensive, costing at the present time £49 per ton, as against £23 for ordinary lead. The antimony is mixed with the other metals to produce a hard surface on the type plate. It is essential that the type should be sharp and clear enough to print several thousand copies before being re-melted.

The melting point of the tin and antimony is much lower than the lead, and both are volatile. It therefore becomes necessary to work the metal at a predetermined temperature—one averaging from 580° to 620° Fahr.; otherwise failures would result through overheating. The additional cost of gas is not a serious matter when dealing with small quantities of metal—say, anything up to one ton charge; but it is when we go higher and get to the 7-ton pots that the fuel costs become the prime factor. Several 7-ton pots at the large newspaper houses have been heated by gas. The burners in each case were designed so as to give a uniform heat to the bottom of the pot; and with the aid of specially constructed flues at the sides, the metal was melted from atmospheric temperature to 600° Fahr. in two hours and forty minutes.

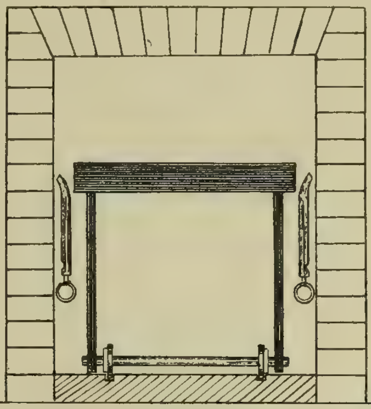


Fig. 4.—Furnace for Firing and Bending Glass.

If the metal is not required at the moment for casting into plates, auxiliary burners are used which keep the temperature at 600° Fahr., without any attention, for an indefinite period, with a consumption of 180 cubic feet per hour. One of the pots mentioned was put under test, and it was found that three plates per minute (each weighing 50 lbs.) could be cast and cold ones replaced and worked under these conditions for two hours without a break, and the temperature of the metal at the end of the run showed only a slight decrease. It would not be possible to do this with solid fuel; so that the extra cost of melting by gas can, to a large extent, be written-off as cancelled by the saving of time and the increased production.

For melting small quantities of metals, such as spelter, alloys for die-castings, lead, or tin, the natural-draught gas-heated furnace is mostly used. The melting of hard metals such as gold, copper, brass, &c., is engaging the attention of furnace builders, and, judging by the strides they are making, I feel confident that before long we shall be able to secure much business in this direction.

Heating Large Quantities of Liquids.

There are a large number of factories having vats containing liquids which are required to be heated. In most cases this is at present done by steam injection; the steam being supplied by boilers fired with solid fuel. I have found it a waste of time to endeavour to provide quantities of steam by applying gas to central supply boilers—the working costs being too great. It is found that many firms work their boilers at high pressures, not necessarily because the goods they are treating require such a high temperature, but because the boilers are being overworked or that the pipes are too small. In many instances the actual steam pressure required may be as low as 5 lbs. to the square inch; and it is in cases of this kind where gas can sometimes be applied with an actual saving in the working expenses.

Steam is largely used in works for heating presses, boiling soaps, pickles, jams, glue, wax, and many other soft stuffs. For melting these soft goods, excellent results are obtained by using gas-heated jacketed pans. For heating presses, such as are used in the printing trade, or vulcanizing tables, &c., good results can be obtained by attaching a boiler underneath.

For supplying saturated steam for shrinking, pleating, fumigating, wood bending, &c., gravity-fed evaporators will always meet the case, as shown by fig. 5. They are very cheap to instal and efficient in working.

Heating the rollers of large mixing and rolling machines has hitherto always been done by passing steam at high pressures through channels bored in the rollers. I recently got an enterprising firm, who were installing new machines for making a vulcanite substitute, to allow me to try gas for heating the machines. A 3-inch bore was put right through the journal and shaft of the machine, and a bunsen flame inserted into the mouth. The results obtained were highly satisfactory. The working temperature was reached in a very short time, and the ease of control was found to be quite as good as when the machines were heated with steam.

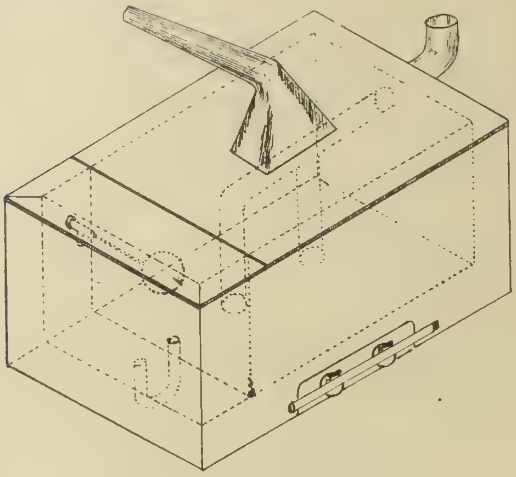


Fig. 5.—Water Evaporator.

HEATING WATER OR ACIDS IN VATS.

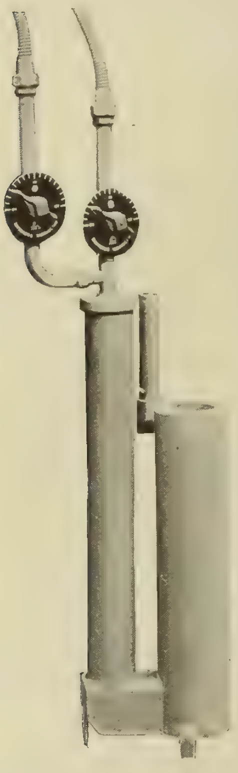


Fig. 6.—Internal Heater.

Specially constructed internal heaters have been installed with satisfactory results for boiling water in 200-gallon vats required for the cleansing and extracting of the marrow from large bones. The vats in question were constructed of wood, and could not be heated externally. This installation is illustrated by fig. 6. The heater in this case can also be used for melting soft metals, such as lead and tin.

Where large quantities of water or acids are required to be raised to a moderate temperature, it can be done by using another form of internal heater, which was recently fitted at a large electro-plating works in London. The vats in this case were also made of wood and lead-lined; lead being the only metal which the acid does not attack. The usual method of heating is to pass steam through a lead-pipe coil. By referring to fig. 7, it will be seen how the internal gas-heater is applied.

The heater is made of lead and amalgamated to the lead lining of the vat by the aid of an oxy-coal-gas blow-pipe; the size of the pipe being governed by the quantity of liquid to be heated. A bunsen flame is inserted into the mouth of the heater, and the heat travels through the pipe and exhausts through the open ends which project above the top of the vat. The portion of the tube which is standing above the liquid has a sleeve of brass of sufficient length to reach below the liquid line inserted into the bore of the pipe; and the space between the two pipes is packed with suitable non-conducting material. This precaution prevents this portion of the heater being damaged by the heat from the waste gases. Many firms are using vats of this description; and we are looking forward to doing a big business in this direction.

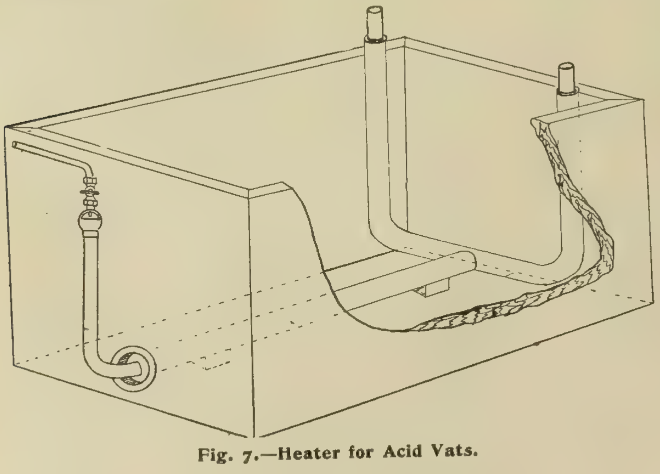


Fig. 7.—Heater for Acid Vats.

EVAPORATING AND STOVING OVENS.

Steam is much preferred for evaporating and stoving by a large number of manufacturers, chiefly because there is very little danger of the goods being discoloured during the heat treatment, as the heat is by convection. In an ordinary stoving oven, the heat is applied internally, and the results obtained are generally satisfactory. A temperature of 160° to 300° Fahr., with a normal air change, is sufficient for most purposes, such as fixing enamels, varnished and lacquered goods. For treating high-class goods, the externally heated oven is best, as the heat obtained is solely by radiation, and the chances of discoloration are reduced to a minimum. But, of course, the gas consumption is considerably more; being in most cases doubled.

The working of an evaporating oven is somewhat different; its chief requirement being to supply quantities of air, heated up to 200° Fahr., for absorbing moisture from saturated material, which is required to be thoroughly dried without the slightest discoloration taking place. Undoubtedly, steam coils or radiators, with a system of induced air, give excellent results; but it can be done just as well by using properly-designed convected gas-heaters. Fig. 8 shows a heater designed and fitted at a colour works; and the results obtained were very satisfactory.

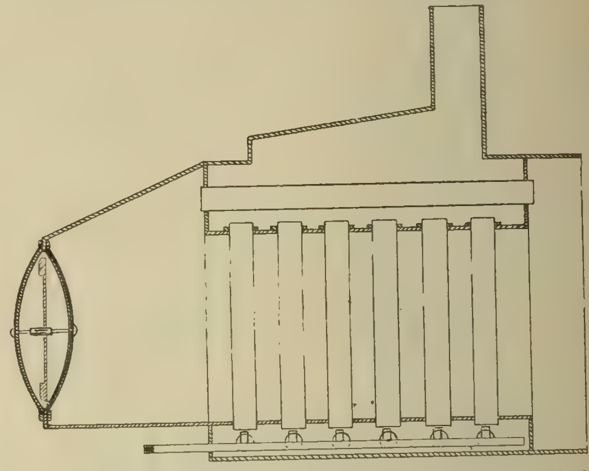


Fig. 8.—Section through Hot-Air Generator for a Colour Works.

I find colour manufacturers very conservative and prejudiced against gas. I have taken a sample of material—such as primrose chrome, a very delicate colour—and told them it was treated in an oven heated by gas. Though it was in every respect equal to colour dried in ovens heated by steam-coils, they still remained in doubt as to the suitability of gas; and it was only by perseverance that they were persuaded to make the change.

ROASTING ORE.

Fig. 9, shows a furnace which was recently constructed for roasting wolfram ore to produce ferro-tungsten. The ore is first crushed and then heated in a furnace to 1600° Fahr., at which temperature certain properties, such as bismuth, tin, arsenic, &c., will vaporize. The material is then drawn from the furnace and fused either electrically or chemically. The furnace consists of a number of tubes, 11 feet long by 10 inches in diameter, fitted horizontally, and heated by blast burners having a tangential motion. The material is put in at A and drawn at B; arrangements being made at C for admitting air. The released gases are drawn off through the ascension pipes D. Each tube is capable of roasting a ton of ore per hour with an average consumption of 800 cubic feet of gas. Tungsten is now being made in this country in fairly large quantities. Prior to the war, its manufacture was monopolized by the Germans. It is used for making high-speed steel tools, which are required by all engineering firms engaged on munition work.

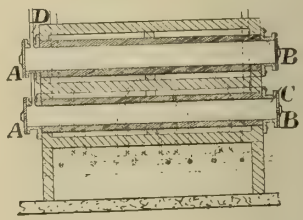


Fig. 9.—Sectional View of Ore-Roasting Furnace.

SUGAR BOILERS.

Many forms of gas-furnace are found to be suitable for making confectionery, jams, &c. In boiling sugars great care must be taken to see that the heat is applied uniformly to produce an even boil. Confectioners require a furnace that will heat 56 lbs. of sugar to 320° Fahr. in about twenty minutes. A quick and even boil produces a good colour, which is very essential when making light-coloured goods, such as acid tablets, &c. Boilers fitted with efficient natural-draught burners are suitable for low temperature boils; but high-pressure gas or blast burners must be used when cooking at high temperatures.

Caramel Toasting.

An appliance was recently supplied which was specially de-igned for toasting caramels. The caramel, which is of a creamy ature, is required to be toasted on the surface without the inside eing cooked. It is therefore necessary to employ a strongly oncentrated heat to produce the desired results. Toasters for his purpose can be made any length, and will toast as fast as the perator can feed.

Glue Melting.

In factories where large quantities of glue are used, manufac-urers prefer to melt 50 lbs. or more in bulk, and ladle into bench ots when required.

Fig. 10 shows a heater with hot-water storage and thermostatic as control. Glue worked at a maintained temperature of 170° ahr. gives the best results. By using a system where a pre-etermined temperature can be obtained, any overheating of glue avoided and waste reduced to a minimum. A dual service is endered by the apparatus, as a constant supply of hot water is vailable for general use.

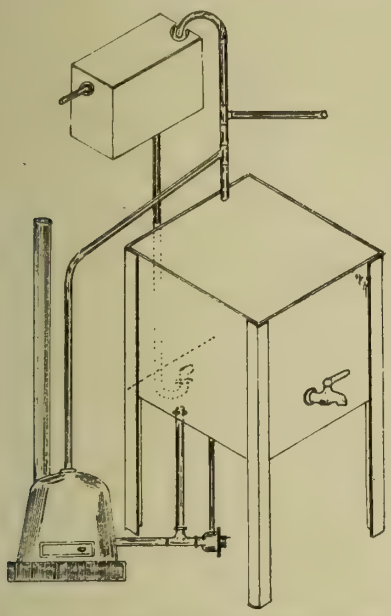


Fig. 10.—Glue-Heater, with Hot-Water Storage.

Concluding Reflections.

One could go on describing special gas apparatus almost for ver; but I think I have dealt with sufficient to prove that gas, s a heating agent, has established itself. It is clean, easily regu-ted, cheap in labour and cost, also the furnaces are more com-act and require less floor-space than those heated by solid fuel. his alone is important from the manufacturers' point of view, ore especially in London, where rents are high. By using gas-rnaces it often means that more can be installed in the same pace, which aids the output, and thereby helps to cheapen the ost of production. Undoubtedly the chief reason why the de-and for gas-heated appliances is on the increase is that the akers of these appliances and the gas companies endeavour to e that only goods are supplied which will render thoroughly fficient service.

It would be impossible for anyone to describe in a single lecture e number of cases where gas can be employed; but to give an lea of the probable number, I have selected three trades—viz., otor engineering, printing and book-binding, and confectionery -and will bring my paper to a close by reading a list, which hows that gas can, in these trades, be used for forty different urposes. I therefore think the title of that admirable monthly eriodical published by the British Commercial Gas Association, ntitled "A Thousand and One Uses for Gas," does not in any ay overstate our case.

Motor Engineering: Work done by Gas.—(1) Gears: Parts annealed and hardened. (2) Gear boxes, number plates, foot boards, made of aluminium, melted by gas. (3) Pins and bolts hardened. (4) Springs hardened and tempered. (5) Iron tyres: shrinking, pre-heating prior to welding, and shaping. (6) Body: stampings annealed and, after being assembled, stoved in enamelling oven. wood bodies: panels steamed in gas-heated closet for bending. (7) Lamps: metal annealed prior to spinning; finished article either lacquered or plated—both processes being aided by gas. (8) Lathe and machine tools hardened and tempered. (9) Rubber tyres repaired by gas-heated vulcanizer. (10) Lubricating oil clarified and blended. (11) Petrol distilled. (12) Cylinders: Fractures repaired—furnaces used for pre-heating, and oxy-coal gas blow-pipes for welding. (13) Chassis repaired and straightened by oxy-coal gas blow-pipes.

Printing and Book-Binding: Work done by Gas.—(1) Type metal melted for large plates, small type, stereo work, blocks, &c. (2) Blow-pipes used for stereo work. (3) Furnaces used for hardening and annealing. (4) Oxy-coal gas blow-pipe used for welding. (5) Steam raised for presses, drying moulds, warming ink ducts and rollers. (6) Stoves in pits used for warming machines. (7) Glue heated. (8) Rollers heated for bending cardboard backs. (9) Tools heated for letter and line work. (10) Presses heated for gold blocking. (11) Water heated for washing stones. (12) Litho. stones dried. (13) Radiators for warming factory. (14) Hot water supplied for staff.

Confectionery: Work done by Gas.—(1) Boiling sugar. (2) Toasting caramels. (3) Drying gums. (4) Roasting pea nuts. (5) Drying powders. (6) Making syrups. (7) Washing bottles and jars. (8) Drying bottles and jars.

DISCUSSION.

At the conclusion of the reading of the paper, a number of questions were asked by the members and fully replied to by the author. A few of the points that were raised may be noted.

Mr. G. F. Cox (Commercial Gas Company) remarked that Mr. Brooks appeared to be rather fond of the downward application of gas to furnaces; and he was wondering whether he had any particular reason for this. Could he manipulate his furnaces better than with an upward draught? One of the illustrations was of a furnace for glass; and he took it a furnace of this description could easily be arranged with a movable roof, so that it could be brought down as close as might be desired to the article to be heated. There seemed in the illustration to be a good distance between the top of the trolley travelling through the furnace and the crown. Had the author had any experience of drying isinglass, and, if so, had he had any difficulty from the drying being affected by the saturated condition of the air in the chambers?

Mr. W. L. Westbrook (North Middlesex Gas Company) said the subject dealt with was an important one. So far as many of the members were concerned, the question of the industrial applications of gas was a comparatively new one. The matter had hitherto been largely in the hands of specialists, to whom they looked for keeping things up to date. Salesmen would find the list given at the end of the paper particularly useful; for it would suggest to them promising fields in which to employ their energies. With regard to the brazing forge, how were the products of combustion disposed of? In the application of gas to stereo melting work, or similar purposes, where it was necessary to keep the temperatures at an exact point, owing to the volatile nature of the material dealt with, it struck him that any variation in the calorific value of the gas was liable to throw the operator out. Could the author tell them what was the efficiency of the internal method of heating vats? As to enamelling work, some years ago he had considerable trouble with an oven used for this purpose. The operator was a skilled man, who had used the enamelling ovens for a very long time; and suddenly he began to complain. He was in the habit of regulating his work by time; and although there was a thermometer, he did not think he made use of it. When he began to complain, he was troubled with bloom coming on the enamel, and spoiling it. Was this due to insufficient change of air, or to what could the trouble be attributed? Perhaps Mr. Brooks could inform them what the proportion of flue outlet to the cubic contents of the oven should be, or whether the flues were usually adjustable. He took it that for ore roasting the 800 cubic feet of gas mentioned was per tube.

Mr. D. J. Winslow (Lea Bridge) said there was one point on which he would like to ask Mr. Brooks's opinion. In the case of such work as forging ⅝-inch copper armature rings, he believed high-pressure gas could be used, and also low-pressure gas with a fan. Supposing a firm already had high-pressure gas lighting installed, would it be advisable for them to go to the expense of providing a separate air fan, as some people thought low-pressure gas with a fan was better for the work? He appreciated the remarks with reference to the conservatism of people who at present used coke instead of gas. They were very glad to see gas undertakings giving their attention to this matter, and starting demonstration rooms as a means of educating people in the various uses of gas. The two principal points to keep in mind were the conservatism of manufacturers and the price of gas.

Mr. Brooks, in reply, expressed the opinion that in forging one could get far and away better results by a downward application of the flame. He should think the difference might reach from 30 to 40 per cent. in favour of this method. But, of course, he did not always bind himself to downward application. In some cases it was not so suitable to use. A suggestion had been made as to the roof of the glass furnace being arranged on a movable plan; but this he did not think would prove practicable. A better way would be to so design the trolley that it could be raised or lowered as desired. Some work required a good distance between the trolley and the roof. Reference had been made to the list of uses of gas given at the end of the paper. What he did was to take each trade separately and endeavour to master it by the aid of technical papers and books relating to it. In this way, he was able to find out just where gas would be useful; and the results were surprising. As to the brazing forge, the gases exhausted at each end. The concentration of the flame was so intense, that practically one did not see the exhaust taking place at all. The possibility of variation in the calorific value of the gas was one of the reasons why he had discarded high-pressure gas and gone in for the blast system, which was undoubtedly the system of the future. The efficiency obtained with the internal heater, when placed in a vessel with a sealed top, was something like 80 per cent. The bloom on enamel which had been spoken of must, he thought, have arisen from a cracked oven, or faulty luting round the mouth, which allowed the products of combustion to get inside. In the matter of flue outlet, he always gave the largest, and provided a shutter or flap-valve for regulating it. One might sometimes wish to raise the heat rapidly, and at others require a very slow process; and a large flue adjustably arranged would do for both. He had been asked whether, in the case of high-pressure gas being already on the works, he would recommend the air-blast system for forging armature rings. This would just depend. The forge they had designed for the breeches of rifles was worked by high-pressure gas, which gave very good results, though personally he considered he would do better with blast. The point for the consumer to decide, in the case put forward, would be whether he was prepared to spend a little money to get better results, or preferred to have fairly good results with high-pressure gas. He had not had any experience of the difficulty which had been referred to in the drying of isinglass. The oven must, of course, be properly ventilated; and as it would not cause discoloration, it seemed to him that internal application of the gas would be the thing—with a very good circulation.

The President (Mr. S. B. Chandler, of the South Suburban Gas Company) said the paper would certainly assist them to realize the part played by gas in the industries. One of the most important things in furnace work was, of course, exactness of temperature; and he did not think—with perhaps the exception of the electric furnace, which could only be used for small work—there was anything but gas which could offer them this. Mention had been made of the conservatism displayed by manufacturers and others. This conservatism, of course, existed; but it was their mission as gas men to educate the public to use the commodity they offered. If they could do this as successfully as Mr. Brooks, there would not be much to complain about. It had been a great privilege to have him there.

Mr. F. Pearce (North Middlesex Gas Company), proposing a hearty vote of thanks to the author for his paper, remarked that what had struck him particularly was that, besides knowing his own business, Mr. Brooks seemed to know a good deal about other people's. This might be not always desirable; but in the present case it certainly was. He understood that in the enamelling furnace of which complaint had been made, the gas-burners were inside; and from this he assumed that the products of combustion came into contact with the articles being enamelled. He would much like to know whether the purification arrangements at the gas-works were the same as they had hitherto been. A thing like this did not happen without there being a cause for it.

Mr. Westbrook remarked that the trouble extended over a considerable period of time; and it was not through the purification at the gas-works being at fault.

Mr. G. H. Lloyd (Gas Light and Coke Company) seconded the vote of thanks, in which was included Mr. Grover, who had assisted Mr. Brooks during the reading of the paper.

Mr. Brooks, after acknowledging the compliment, said that in the case of stoves constructed of iron, condensation was apt to take place on first lighting up; and this might have been the cause of the enamelling trouble.

Mr. Westbrook said that afterwards they constructed an oven inside the other, and carried the gas round it; but this did not altogether get rid of the trouble.

Mr. Brooks replied that this seemed to show that the ventilation was at fault.

Coke and Price Limitation.—The opening lines of the current coal market report in the "Iron and Coal Trades Review" throw a little light on what the coal trade think of the use of coke for domestic purposes at the present time, when the Ministry of Munitions are anxious to promote the output of gas for the sake of the requisites for the production of high explosives. The lines in question read: "While inland coal prices are controlled by the Limitation Act, coke is not included within its provisions, and continues to become dearer. But it is rumoured that producing collieries have come to some sort of a voluntary understanding whereby any further upward movement is likely to be checked, although what basis has been agreed upon has not transpired. Something of the same sort appears to be needed in regard to gas coke, which is very scarce and expensive, although householders were recently somewhat absurdly recommended officially to use it as a fuel for the sake of economy."

Sulphuric Acid Supplies in Germany.—Germany has had, says the "Manchester Guardian," to find a new way of obtaining the large quantities of sulphuric acid which she requires in the manufacture of high explosives, sulphate of ammonia, and other necessary products, as the raw materials hitherto largely used cannot now be imported, and there is a great shortage. The chemists have worked out a method of making sulphuric acid from sulphur-containing minerals, such as kieserite and gypsum, which occur in rather large quantities in Germany; but it has the drawback of costing much more than the ordinary process. The Government have got over this difficulty, however, by granting £150,000 for new plant, promising more money if it is required, fixing a standard price which will cover the expense of manufacturing by the new method, and then imposing a tax upon products obtained in the old way, so that those who are able to follow it shall not reap a special benefit during the war.

LIGHTING OF FACTORIES AND WORKSHOPS.

Discussion of the Home Office Committee's Report.

There was a good attendance at the meeting of the Illuminating Engineering Society on Wednesday last, at the Royal Society of Arts, John Street, Adelphi. Mr. Leon Gaster, the Hon. Secretary of the Society, and a member of the Departmental Committee of the Home Office on the Lighting of Factories and Workshops, was down to open a discussion on the report of the Committee. The "opening" of the discussion consisted of the reading of a paper which covered a printed area 22½ in. by 15 in. However, before Mr. Gaster entered on what to him was a very congenial task, Mr. F. W. Goodenough, the Chairman of the Council, introduced the Chairman for the evening, Dr. R. T. Glazebrook, C.B., D.Sc., F.R.S., to whom Mr. Goodenough said obligation was due for having presided over the Departmental Committee. On Dr. Glazebrook taking the chair, there was an expression from him of pleasure at being there to listen to the discussion. He remarked that the Committee were only in the middle of their work. Though they had issued their first report, there was still a great deal to do. Much more would have already been done had it not been for the war. He and his fellow-members of the Committee wanted to hear what the members of the Society of Illuminating Engineers had to tell them concerning the report, because it was the desire of himself and colleagues to make the next part of the report as useful as possible. The need of this work to-day was greater even than it was two years ago when Mr. M'Kenna summoned the Committee and asked them to undertake this particular duty. It was, he thought, clear that whatever might be the victorious outcome of the war, the struggle that would be before the country after that period would be one of great intensity and difficulty. All possible steps should, therefore, be taken to improve the position of the industrial workers, to improve the output, and to increase the prosperity of the manufacturers; and investigation and endeavours of this kind—to ascertain the conditions most favourable for work, and the conditions that were most disadvantageous for work, and to lay down in general terms the requirements for good work, so far as illumination and eyesight were concerned—were fraught with great value and interest in the future.

Notes from the Paper.

After this prelude, Mr. Gaster started off on his long journey through the paper, explaining at the outset that he intended to confine himself to a "few" of the main conclusions of the report. This he did not do, because, preliminary to the report, came much else. He claims, in the introductory matter, that the report is the culmination of a good deal of steady work on the hygienic aspects of lighting which had been done during the last few years. The appointment of the Departmental Committee was not in any sense a sudden decision; but it was the result of years of methodical work. The need for an investigation is fully justified by a variety of circumstances which the author enumerated. The Committee had to start work on altogether new ground—there being an utter absence of any general provisions in respect of lighting analogous to those regarding temperatures and ventilation in the Factory Acts of the United Kingdom. One of the most valuable sections of the report, in the author's judgment, is that in which a summary is made of the legislation bearing on industrial and school lighting in the chief European countries and in the United States. But much legislation is aged and of general character; and something more definite is now possible. In passing, there was acknowledgment that illumination cannot be satisfactorily dealt with by engineers alone, but that the co-operation is needed of experts, physiologists, architects, physicists, and the general public. In the author's opinion, the result of the work of the Committee is a unique publication of which the country has reason to be proud; and, on the subject, there is nothing comparable to it in respect of completeness in the Government publications of any other countries.

Probably, directed to criticisms of the composition of the Committee and the (to illuminating engineers) elementary character possessed by parts of the report, are these words: "The preparation of an official report, to be regarded as a preliminary to legal requirements, imposes a special responsibility on the members of a committee. Its conclusions carry a weight which the suggestions of individual experts or even societies do not; and it must, therefore, be particularly careful to avoid giving expression to views which are not thoroughly authenticated, and to explain its recommendations in the clearest possible terms."

POINTS OF INTEREST IN THE REPORT.

From the standpoint of the Society, the author suggests that the chief points of interest in the report are:

(1) The recommendation that there should be statutory power to demand adequate and suitable lighting in factories and workshops.

(2) The recognition of the value of good illumination as desirable in the interests of the safety and general health of workers, and as an important factor influencing the output and quality of work.

(3) The actual record of work done contained in the appendices comprising data and measurements obtained in many factories, supplemented by the general impressions of the

observers; and the summary of the requirements as regards lighting in the chief European countries and the United States.

It should be particularly noted that "adequate and suitable ighting" is defined, not as involving only the provision of a certain amount of illumination, but also as implying satisfactory conditions in regard to the avoidance of glare, inconvenient shadows, &c. The recommendations of the Committee are unique n that they are the result not only of evidence tendered by a varied set of witnesses, but of personal experience and a very exhaustive series of tests undertaken by the Committee. There s still another volume to come, which will contain a detailed account of the lighting conditions in each factory visited, the measurements of illumination, and the personal impressions of the Committee thereon. These data should certainly be of considerable value, as showing the actual conditions of illumination prevailing in the classes of factories visited.

COMMENTS OF THE TECHNICAL PRESS EXAMINED.

With the view of ascertaining possible points for discussion, he author has been at some pains to examine the comments on he report that have appeared in certain technical papers—the "JOURNAL" among them. He acknowledges the reception of the report in the Press as friendly almost without exception.

In a few cases, it has been suggested that the report contains a needless amount of explanatory matter and even truisms in regard to illumination. Explanations which appear needless to a lighting engineer may be highly necessary to the general public and to backward manufacturers who have not thought much about lighting matters. Moreover, if a statutory requirement of adequate and suitable illumination is made, and penalties are eventually mposed, the precise definition of "adequate and suitable" illumination becomes an important matter. The contents of the report will form the leading guide as to what is meant by this term, and must therefore be framed to meet all such contingencies. Moreover, factory inspectors have not previously been entitled to take general action in regard to defective lighting; and they will have to proceed cautiously and gain their own experience. For their guidance full and explicit information, even on apparently elementary points, will be very helpful.

A few writers, particularly those who are accustomed to deal with lighting matters, and have therefore some knowledge of the order of illumination met with in modern up-to-date factories, have been disposed to think that the minimum values suggested are too low, or to question the principles upon which they are arrived. The author says the values were not put forward without long and careful consideration. One aim of the report is to avoid recommendations which might subsequently be found to be too burdensome, and to involve unnecessary hardships to manufacturers. The researches of physiologists have shown that in general a marked diminution of acuteness of vision begins when the range of illumination is reduced below the range of values specified in the report; yet one's impressions in this respect depend very much on the state of adaptation of the eye and the success with which glaring points of light are avoided. In any case such estimates have to be considered with respect to the conditions actually found in practice. It is not enough to specify what is theoretically desirable, one must make sure that what one desires can be actually carried out. So the estimate was checked by a very laborious series of measurements in many factories.

THE MINIMUM PRESCRIBED VALUE.

The minimum value prescribed in factories—0·25 foot-candle—has been independently arrived at in other investigations. It is, for example, the minimum value found on the platforms of railway stations (where the safety as well as the general convenience of passengers is the chief consideration determining the illumination); and it was independently suggested years ago as a result of investigations in the United States. With modern illuminants, there is usually a considerable variation in the illumination furnished at different points in the room, so that a minimum of 0·25 foot-candle at one point means that the illumination at most other parts of the room will be very much higher. Above all, it must be clearly recognized that these are values in the interests of safety and convenience merely, and that in almost all cases the necessity of providing suitable illumination for the work carried on will in itself go far towards providing higher minimum values. The author therefore thinks that it will be fully conceded that the 0·25 foot-candle value has some justification. Even so, there will occur certain cases, particularly very large rooms and open spaces, where even this value could not be obtained without an unreasonably great expense. The Committee have therefore considered such open spaces separately, and fixed lower minimum values, and have also inserted an exemption clause to meet hard cases. As regards the illumination in large open spaces, docks, &c., he thinks few of those who have seen these large areas in practice will question the advisability of being very lenient in fixing a minimum value. One journal suggests that the value of 0·05 foot-candle in such areas is absurdly low. On the contrary, the author would doubt the wisdom of asking even this value were there not the exemption clause as a safeguard. The best analogy is supplied by the full data available on the pre-war lighting of London streets, so ably dealt with in Mr. Trotter's paper before the Society in 1913. It is seen from this paper that 0·05 foot-candle is about the value met with in St. James's Square, while in the Marylebone Road and in Cambridge Street there was only half this value. It may, of course, be said that in many industrial operations there are points where special danger is incurred—where trucks are passing or where there are risks of stumbling over obstacles and falling a dangerous height. But in such cases the general requirement of adequate lighting would come into force; and if there was obvious danger an inspector would be justified in recommending special measures at these points of work, such as the use of portable lamps, the whitening of surfaces to mark the demarcation from dangerous zone, &c.

A desire has often been expressed that something more definite should be said on the subject of glare, and that a provision limiting the contrast between the illumination on the work and of surrounding parts of the workroom should be inserted. As regards the avoidance of glare, the author thinks the report is sufficiently emphatic. At the present stage, it is, he says, hardly practicable to include in the body of the report hard-and-fast rules for its avoidance, as these necessarily differ so much according to the nature of the workshop. Such precautions should, however, be studied by inspectors and applied by them in giving advice as to how a tendency to glare might be remedied.

As regards the avoidance of excessive contrasts in illumination, this is met by two requirements: (1) By the general requirement that there should be a reasonable constancy of illumination over the working area; (2) by the fact that the minimum general illumination is 0·25 foot-candle. According to Weber, there is no impression of glare provided a contrast exceeding 100 : 1 in brightness is avoided; and even this ratio would perhaps be difficult to adhere to in practice. However, a ratio of 100 : 1, with a minimum illumination of 0·25 foot-candle, would permit of an illumination of 25 foot-candles on the work, which is only required in very exceptional cases.

A few critics of the report have suggested that some more definite information should be given under the heading "how to light a factory." Those who speak light-heartedly of brief and "practicable general schemes" of factory lighting can scarcely have studied the subject in any detail, and can have no idea of the innumerable complex factors affecting the conditions of illumination in various industries. Ideas on this subject can only become crystallized by gradual experiment and discussion in cooperation with those engaged in the respective industries; and it would certainly be foolhardy at the present moment to attempt to make such values a basis of legal action. On the other hand, those who accept the principle of the general recommendations in the report, and supplement this by a study of the data in specific factories presented, are already in a position to make substantial improvements in the more backward factories in regard to lighting; and this is surely a considerable point gained. Finally, the author mentions a few criticisms based on the impression that the merits of one or another illuminant have not been sufficiently emphasized. Broadly regarded, these criticisms, he considers, cancel one another. In one case, the objection was raised that some advantage of electric lighting has not been pressed; in another, the wish is expressed that some merit of gas lighting had been more emphasized. He thinks keen partisans of particular illuminants do not sufficiently realize how greatly these presumed advantages depend on the local circumstances, and how frequently some apparent drawback is due not to any intrinsic defect in the illuminant so much as the unsatisfactory manner in which the illuminant is used. In his opinion, members of the Society will agree that it is far better to aim at constructive work of value to the public and the industry as a whole, than to embark upon controversial side-issues which merely accentuate some points of difference.

FUTURE WORK.

Dealing with suggestions for future work, Mr. Gaster says there is room for detailed and systematic study of the requirements in regard to lighting in specific industries, and no doubt this important piece of work will be undertaken in course of time. It is, however, work that obviously requires very careful treatment, and one cannot expect immediate results. There have naturally been some points on which evidence was less easily gathered than others; and reference is made to several particular lines of investigation which would be helpful. One of these is the effect of inadequate illumination in causing eye-strain or general fatigue. This is a matter in which the co-operation of the physiologist and the occulist is necessary; and in future a study should be made of some way in which the records of eyesight, nervous breakdown, &c., recorded by such specialists can be correlated with the lighting conditions which the sufferer has been experiencing. Only by slow systematic work of this kind, can there be hope of gradually tracing the connection. The physical condition of workers is of great importance at the present moment; and a Departmental Committee, under the auspices of the Home Office and the Minister of Munitions, has recently been appointed to deal with the subject. An opportunity of bringing before their notice the relation between inadequate lighting and fatigue was recently afforded; and no doubt they will consider the work of the Departmental Committee in the course of their researches and in framing their recommendations. There seems at present to be a need for some general method of testing fatigue of eyesight—not at irregular intervals, but over a continuous period, so that any fatiguing effect characteristic of the lighting system has time to make itself felt.

Another line of investigation, which perhaps offers even greater immediate prospects, is the study of the connection between illumination and output and quality of work. Several witnesses were able to mention to the Committee actual instances of a measured gain in output and quality being observed when the conditions of illumination were improved. It would, Mr. Gaster suggested, be most useful if those members of the Society who are contantly dealing with industrial lighting installations were to begin to make a study of this matter, and to collect evidence. In the future, such statistics would prove a most powerful appeal to manufacturers.

Concluding the long but interesting paper, Mr. Gaster remarks that light is a necessity, and not a luxury; and, even in time of war, it is necessary—perhaps even more necessary than in time of peace—to ensure that it is wisely employed. England has for long been justly regarded as the home of industrial hygiene; and the Society owes a debt of gratitude to the Home Office for the judicious and energetic manner in which they have taken industrial illumination under their wing, and particularly to the Chairman of the Committee who has devoted so much time and care to these researches.

DISCUSSION.

Dr. René Sand (Brussels), invited by the Chairman to speak, had a very enthusiastic reception. He remarked that he greatly appreciated the kindness of the members. The work of the Society was viewed by him with the keenest interest and pleasure. He hoped that after the war the Belgian Government would take steps in connection with the matter of factory and workshop lighting, and urgently press it forward. In the work of the Illuminating Engineering Society they would find some very useful data.

Dr. James Kerr (London) said he read the report of the Departmental Committee with a great deal of curiosity to find out what recommendations had been made. It occurred to him it would be an extremely intangible thing to handle factory lighting; but fortunately the Committee had taken the very high ground of only dealing with principles. It seemed to him that among the further work that would develop out of the report would be the question of fatigue of the eyesight. The matter of glare was also extremely important. He thought the report also dealt with the intrinsic brightness of the source of light, and this was a thing of the greatest moment.

Mr. W. R. Cooper (London) said he was glad to see the Committee had taken up the point as to the comfort of the workers. This was very important. If they wanted the best of work, they must have people working under the best of conditions; and if this idea had been grasped by employers years ago, much trouble would have been saved. In his opinion, the 0·25 foot-candle for minimum illumination was too low; and if the Committee could raise this, it would be an advantage. It also seemed to him that the term workroom was too vague; for there must be a great variation between one workroom and another. A workroom, for instance, in an engineering factory differed materially from one in a textile factory. He did not know whether reference was made in the report to the question of exposing sources of light to the eye; but if not, and the Committee would deal with the matter, it would be a great advantage. To expose metallic filaments directly to the eye was wrong; he sometimes saw them used with clear glass globes, and without hesitation by people who ought to know better. This point would be more important still when the "half-watt" lamp came into use.

Mr. A. Cunnington (L. & S. W. R.) thought that the Committee, in arriving at their conclusions, made more use of actual measurements than they did of the expressed opinions of witnesses; and this suggested the value of actual measurements. He was inclined to think impressions were a little vague even when the persons were accustomed to deal with lighting problems. It was surprising how much one could be out in general impressions compared with actual measurements. He noticed one witness suggested they should have a minimum of 2 foot-candles for corridor lighting. He had worked out what this would mean. If they had lamps suspended in a corridor at 8 feet high and spaced 17 ft. 3 in. apart, they would have to have lamps of 200-candle power, which would give 8 foot-candles under the lamp and a minimum of 2 foot-candles—measured on a plane 3 feet above the floor. He found that the new office at Waterloo Station had a minimum of 0·1 foot-candle, which exactly carried out the recommendation of the Committee, and the maximum was 0·3 foot-candle. In the passage outside the office of the "Illuminating Engineer," he found the minimum was 0·13 foot-candle; and in the corridor outside the office of the Institution of Gas Engineers, the minimum light was 0·07 foot-candle! One lamp, however, had been removed there, no doubt owing to the restrictions, so they might take it the minimum would normally be about double—say, 0·15 foot-candle. Lighting could easily be too extravagant. Referring to high-pressure gas lighting, the remark was made by one witness that, as a rule, they kept the standard of lighting up as high as possible, chiefly on account of the fact that they could give an abundance of light cheaply. This was an uncommercial way of looking at it. When people suggested such high values, there seemed to be something wrong somewhere. As one interested in railway yard lighting, he thought the minimum of 0·05 foot-candle erred in being too high. Take a yard of 14 acres in extent, to give a minimum of 0·05 foot-candle would mean a high cost. The yard that he had now in mind had a minimum of 0·01 foot-candle; and it was considered a well-lighted yard. To comply with the recommendation of the Committee to give not less than 0·05 foot-candle the cost would have to be increased from £300 to £1500. They might do it for less if lamps were spaced closer. This was for electric lighting; but the cost for high-pressure gas worked out to roughly about the same. The figure of 0·05 foot-candle for yard lighting was ridiculed by the "Journal of Gas Lighting." When at the "Journal" office recently, he thought it might be of interest to take a figure on the floor of the publishing office. He did not know whether they would regard this as a working area, or whether it would be considered a passage or "open yard." The figure given by an actual measurement was 0·035 foot-candle. But he need hardly say that the interior part of the office was not at all badly lighted. The low reading was partly the effect of shadow, and the light coming from the ceiling; but where the office work was done, the illumination was adequate. He mentioned this because there was no danger at all with an illumination of 0·035 foot-candle. In this matter, they should bear in mind that they were not talking of averages; it was only the minimum that was legalized.

Mr. C. C. Paterson (National Physical Laboratory) said he recommended those who were keen on the general conditions of lighting to study the next volume of results which was going to be issued by the Committee. It really formed part of the first report, and would represent a piece of work which he thought no other country had done anything towards at all. It would be quite a unique compilation of the conditions of industrial lighting.

Mr. Justus Eck (London) agreed that one of the most important things they had to consider in illumination was undoubtedly the effect upon eyesight. He thought it was very sad to look round any gathering of people, and see so many having to wear spectacles. If such a report as that issued by the Committee could make spectacles less necessary, a great service would be done not only to the country, but to the whole world. In their factories, they were always hurrying on—getting machines and people to work faster; and unless they could get the conditions of lighting which would make every operation safe, they would be forcing the pace at the expense of accidents. He thought that the colour of the light source should also receive consideration.

Mr. L. Solomon spoke as an architect; and his practice in regard to lighting seems to be to ask a manufacturer client where he wanted light chiefly and how much he wanted, and then he (Mr. Solomon) arranged accordingly. He agreed that this was rather rule-of-thumb procedure.

Mr. Swainson thought the question of lighting should be taken into consideration in connection with heating and ventilation; and in his opinion the matter of fatigue should be inquired into not only in relation to lighting, but with the factors of heating and ventilation included.

Mr. G. Campbell said the report, apart from its collection of miscellaneous information, must, from the point of view of its recommendations, be regarded as a dismal disappointment. Irrespective of the explanation, anyone who had any practical experience must know that an illumination of 0·25 foot-candle for factory lighting was totally inadequate for 99 per cent. of examples. He presumed that the intention of the Committee was to obtain legislation that would compel all factory proprietors to adopt necessary lighting, in which case they might also presume that the Secretary of State for the Home Office would make investigation as to the general practice, and when he was informed that the present every-day lighting was equivalent to the recommendations, any proposed legislation would be vetoed. In his (Mr. Campbell's) opinion—and he was responsible for a considerable number of important and satisfactory installations—the Committee had missed a great opportunity in not coming out with a flat declaration that the minimum result for good illumination in workshops was generally ⅛ foot-candle, and the lighting of factories generally was bad. Consultants and others who followed the recommendation laid down as to the minimum for lighting would be sadly disappointed.

Mr. F. W. Goodenough (London) said he must differ from the last speaker in regarding the report as a dismal disappointment, because he thought it was a very great achievement to have got established the principle that adequate and suitable lighting for factories and workshops should be a statutory requirement. In these matters, it was very necessary to make haste slowly; to build the foundations securely before beginning to put up the big superstructure. He therefore thought the Committee had done wisely in making a small beginning in regard to the minima they specified, while making a large beginning in establishing the principle that good lighting in factories was one of the conditions that should enable them to be passed as satisfactory by the Home Office Inspector. It was an important principle in legislation not to go too far in advance of public opinion, or the law would be brought into contempt, and thrown into disuse. It was the work of the Illuminating Engineering Society to advance public opinion on this question of satisfactory illumination, and as to minimum, maximum, and average illumination; and if they could educate public opinion in this respect, they would get legislation to follow afterwards. Legislation must be subsequent to the education of the public, or it would fail in its effect. Instead of calling the report a dismal disappointment, he should echo the expression used by Mr. Gaster, that it was of service to the public while not inflicting a hardship upon the manufacturer. A point that fell from the Chairman when introducing Mr. Gaster struck him as touching upon one of the very vital problems of the day—that was, when he referred to the difficulty after the war of increasing the output of factories by every possible means. It appeared to him that the great problem of the nation, not only at present but years to come, was how to increase the output of the wealth of is country—that was to say, the output of labour—in order to rovide the means to pay for the terrible cost of the war. If by e adoption of statutory requirements they could bring about a ational increase in the output per man, they would have done a ervice to their day and generation. In this respect, as he said, e Home Office Committee's report was a valuable step in ad- ance. In his very interesting and valuable contribution to the iscussion, Mr. Cunnington made a remark to which he should like refer, when he spoke of the man who advocated his own par- cular system of lighting because by it he could give plenty of ght cheaply. Mr. Cunnington must bear in mind that it had nly been by the advent of cheap illumination that they had had e standard of lighting raised to anything like the decent figure t which it was to-day. It was the same line of argument that the etallic filament lamp maker would use as against the carbon fila- ent lamp—namely, that he was able to give a factory more light ecause it was cheaper—he distributed the advantage between etter result and economy. If they had not got beyond the candle -day, they would not be able to prescribe satisfactory standards f lighting for factories.

Dr. Glazebrook, in closing the discussion, said that he and his ellow members of the Departmental Committee had felt that the iscussion had been a real advantage to them in respect of future ork. The questions raised by Dr. Kerr and Mr. Swainson as to atigue, the effect of glare, and so on, were very important.

Mr. Gaster, in his reply, also admonished Mr. Campbell re- arding the views he had expressed. He agreed, too, that it was bsolutely essential that the personal element should be taken nto consideration, and experiments on the question of fatigue ade on a comparative basis with the same persons and under he same conditions in relation to heating and ventilation.

A cordial vote of thanks was passed to Dr. Glazebrook for residing.

PROGRESS IN ILLUMINATION.

American Illuminating Society's Report for 1914-15.

In last week's issue, pp. 434-5, some extracts were given from he report of the "Committee on Progress" of the American Illu- inating Engineering Society. To-day's further extracts may be refaced by what the Committee remark in the opening words of heir statement: "During the past year there have occurred two vents of striking significance, which may be symbolized by two laming torches—one signalizing destruction and conflagration, the ther spreading its glow over construction, progress, and enlighten- ent. One heralds animosity and antagonism; the other dis- loses amity and friendly relationship. The one is the sign of ar; the other a proof of peace. In spite of the one, progress has ontinued; in conjunction with the other, the art of illumination as been extended. The European war, repellent in its awful arnage, has afforded grim and hitherto undreamt-of possibilities n the use of light. The Panama-Pacific Exposition welcomes the hole world, and stands as a magnificent example of the art of pplied illumination." But, leaving aside the former "repellent" ubject, we start with the section of the report dealing with

The Panama-Pacific Exposition.

In its use of light, the Panama-Pacific Exposition furnishes the ost striking example ever presented of the progress of illuminating ngineering. For the first time in the history of such institutions, recognized illuminating engineer was called in to take care of his branch of the work. For the first time in history the lighting f an International Exposition was completely designed and harted before the buildings were erected; and the results bear loquent testimony to the wisdom of the action. The latest types f street lighting, both gas and electric, are represented; the ex- eriors of the buildings are brilliant with "flood lighting;" the ighting of Festival Hall is a unique example of totally indirect ighting; display lighting is exemplified in the scintillator system and in the Tower of Jewels; efforts to avoid glare are manifest on all sides; never has there been a more lavish use of coloured light. And so this exposition stands as a living witness to the fact that illuminating engineering has "come into its own."

No attempt will be made to discuss all the novelties to be found in the lighting effects, but reference will be made to some of the more prominent features of the illumination. The basic idea back of the general illumination of the building was the desire to present the exposition at night in the same relative values of colour and perspective in which it is observed by day. On this account the old outline-system of illumination, in which incandescent electric lamps were used to outline the architectural features of the buildings, was abandoned for the new flood-lighting idea; and particular attention has been paid to the ocular comfort of the sightseer while at the same time displaying for his appreciation wonderful effects produced by artificial light.

Four principal methods of illumination are employed. Opposite the walls of the exhibit palaces are luminous art standards bearing transparent shields, through which light is thrown on to the façade. A second method of illumination is found in the concealed batteries of searchlight projectors which are used to flood the monumental sculptures, towers, and minarets, so that the minutest architectural details are visible. A third source of lighting is that of the concealed light which proceeds from the inner recesses of the columns which encircle the courts or are placed on the lofty Tower of Jewels and the Italian Towers commanding the entrance to the Court of Palms and the Court of Flowers. This method of lighting is also used in the vaults of archways and in other situations where it is desired to cast light upon the mural paintings. The great battery of forty-eight searchlight projectors, each with a 36-inch lens forming the "scintillator," makes a fourth source of illumination.

In addition to these four principal sources of lighting, there are several minor sources. In various parts of the grounds are globes of white glass the light from which, at night, dissipates the shadows under the foliage. In the great central Court of the Universe two lofty columns of dense white glass are parts of the two fountains, and are the principal source of the night illumination of the Court.

The striking effect of the Tower of Jewels was obtained through the use of specially designed jewels cut from glass obtained in Bohemia and having an index of refraction of from 1·68 to 1·71. Each gem is suspended so as to be free to swing with air currents, and has a little mirror placed within one-sixteenth of an inch of the apex, thereby increasing the number of spectra obtainable.

A noteworthy feature of the highway lighting is the use of 18-inch to 24-inch globes carrying glassware of an absorption of approximately 50 per cent. and of a warm opal tint approaching amber. The illumination of the interiors of the buildings is accomplished by the use of 250-watt and 500-watt tungsten lamps in specially designed mirror reflectors. The lamps are from 40 feet to 100 feet above the floor, the energy is less than 2 watts per square foot, and the foot-candles range from ½ to ¾ on the floor.

The first commercial installation of high-pressure gas lighting in this country, and one which is said to show many improvements over foreign practice, is to be found in the State and Foreign Building Section. The main artery for traffic is the Avenue of Nations; and this and other streets and avenues in this section are lighted by high-pressure two-mantle lamps enclosed in opal globes mounted single on the top of ornamental staffwork columns. The lamps consume 21 cubic feet of gas per hour, operate at 3 lbs. pressure—reduced at the standard from 30 lbs.—and have a mean spherical candle power of 408.

Installations of the same lamps have been made at all the entrances and exits of the grounds. At the entrances and exits of the main group of exhibition palaces, and at the entrances of the courts, lamps of the low-pressure type are used, mounted on brackets. In the "*Zone*" gas-standards 35 feet high are placed at intervals of 100 feet on both sides. There are 72 of these standards, each carrying five-mantle lamps with mercury-valve distance-control. Large decorative lanterns are hung about these lamps. Decorative effects are obtained by the use of gas to produce tongues of flame from serpent-headed urns.

Some very spectacular effects are obtained in the lighting of the glass dome of the Palace of Horticulture. These effects are made possible by the use of sets of specially designed lens plates, colour screens, and high-powered searchlights. The system used in lighting the interior of the Festival Hall is a separate and distinct type of interior lighting which is unique. In a pit beneath the centre of the floor are placed a number of searchlights, which are set to throw their beams upwards into a diffusing disc of thick glass sand-blasted on the under side, which distributes the light over the dome covering the auditorium, and the dome in turn acts as a diffusing reflector. The most bizarre and spectacular phenomena are produced by the "scintillator"—over 300 effects having been worked out.

At the San Diego Exposition neither the "flood-lighting" nor the "outline" system of illumination is used, but ordinary street lighting supplemented by light from the arches of the arcades. This has been found very satisfactory.

Street Lighting.

A general survey of the progress in the lighting of streets shows that there has been a decided increase in ornamental lighting for advertising purposes, or so-called "White-Way" lighting. But, aside from this special ornamental lighting, the following record may be made, mainly regarding gas installations.

Portland, Oregon.—Besides ornamental lighting, some 150 arc lamps have been added for general street lighting.

San Francisco.—A few additional lamps, both gas and electric arc, have been installed—making a total of 3423 arc lamps and 7838 gas-lamps. The most notable improvement has been the installation of 516 gas-filled, 250-candle power, tungsten lamps on the main thoroughfare leading to the exposition grounds. These lamps have been suspended from pipe brackets placed on the trolley poles, two to a pole, and at a height of 16 feet above the sidewalk. The distance between the poles is approximately 93 feet. It is expected that after the close of the exposition the number of lamps will be cut down, as the illumination is much more brilliant than necessary under ordinary conditions.

Milwaukee.—The report on the street lighting survey authorized in 1914 contained among others the following recommendations: That a total of 8500 lamps be used; on residential streets 400-candle power units hung 22·5 feet high on centre suspensions at the street corners, with 100-candle power lamps at the curb midway between corners in blocks more than 420 feet long; for business streets a pair of 30-feet posts on opposite sides of the street every 180 feet, each post carrying two 1000-candle power lamps; semi-residential streets to be lighted by 400-candle power units

360 feet apart; and outlying business streets by 600-candle power lamps at the curb and on 180 feet centres.

Chicago.—The principal changes during the year have been the introduction of gas-filled tungsten lamps in place of enclosed alternating and direct current arc lamps. The following table shows the number of lamps in service at June 1 last as compared with those on June 1, 1914:

	June 1, 1914.		June, 1915.
Flame arcs	10,283	..	10,021
300-watt gas-filled tungsten	—	..	9,020
Alternating current enclosed arcs	6,254	..	1,740
Direct current open arcs	1,272	..	—
4-ampere series vacuum tungsten	4,077	..	7,193
Gas, standard type	11,902	..	10,157
Gas, ornamental type	—	..	730
Gasoline	5,286	..	4,690
Rented flame arcs	1,161	..	1,302

Indianapolis, Ind.—Five miles of boulevard lighting have been installed with gas-filled tungsten lamps of 250-candle power with 150-candle power lamps at irregular intervals between corners and staggered.

Louisville, Ky.—Gasoline lamps have been in service in the parks and along the parkways and operated only in the summer. They are to be replaced by tungsten lamps which run throughout the year.

Detroit.—The lighting system has been extended by the addition of 1669 luminous arc lamps—thus completing the illumination of eleven miles of boulevard.

Philadelphia.—Additions during the year include 400 arc lamps, 650 tungsten lamps, 179 gasoline lamps, and 300 gas-lamps.

New York.—Prior to Jan. 1 last, Greater New York was lighted wholly by three types of units, the enclosed arc lamp, the 100-candle power non-vacuum tungsten lamp, and gas-lamps. Since then the 300-watt to 1000-watt multiple and 400-candle power series type of gas-filled tungsten lamps replaced some 10,000 enclosed carbon and flaming arc lamps. In Queens and the Bronx about 5000 non-vacuum 100-candle power tungsten units have replaced gas. Approximately 600 multiple arc lamps in use on the bridges connecting the several boroughs have been replaced by tungsten units. So far these lamps have withstood traffic vibrations satisfactorily. Negotiations are under way for a large number of tungsten lamps to replace gas-lamps on many of the side streets.

Brooklyn.—All direct-current arcs have been replaced by tungsten lamps. At present [June, 1915], 2000 are installed. Gas-lamps are being replaced by non-vacuum tungsten units.

Montreal, Canada.—An extension of the lighting system is being made by the addition of 84 luminous arc lamps, on ornamental poles of special design placed 125 feet apart.

Panama Canal Zone.—Here permanent street lighting systems similar to those in use in Washington are to be installed in the principal towns. Gas-filled tungsten lamps, probably of 100-watt size, will be used.

Great Britain.—The report issued by the British Government on the use of gas during the year closing June 1, 1914, showed an increase in the number of gas consumers in Great Britain of 357,411. The report also stated that, while the use of electricity for street lighting is increasing, there are still 779,442 incandescent gas units in use.

Berlin.—The number of gas-lamps in use for public lighting in Berlin on March 31, 1914, was 43,780—an increase of 2324. As in previous years, there was an increase in high-pressure lighting in the principal streets. In the inner parts of the city, illumination was strengthened by increasing the number of burners in a lantern, by increasing the number of many-flame low-pressure inverted lamps, as well as by increasing the number of lamp standards. In Victoria Park the electric lighting was improved by the addition of arc and metal filament lamps. There were still in use a small number of petroleum and spirit lamps.

Investigations.—The investigation of street lighting being carried on under the joint auspices of Committees of the National Electric Light Association and the Association of Edison Illuminating Companies, and which was started last year, is still uncompleted. To properly interpret results already obtained requires a complete knowledge of the conditions; and no attempt will be made to summarize them in this report. Another investigation of the factors connected with the effective illumination of streets has been directed toward a study of the effect of glare on visual acuity. The method of test consisted in making observations of a special visual acuity test chart, first with the street lamps off and then under ordinary lighting conditions. Among the conclusions reached were that merely surrounding a brilliant source of light by a diffusing globe does not materially diminish blinding effects. Mounting heights less than 20 feet should be avoided if possible, and heights less than 15 feet should never be employed. When the height is relatively low, the candle power between the angles of 65° and 90° from the vertical should also be relatively low. So far as avoidance of glare is concerned, there is no object in increasing the height beyond 50 feet.

Other Exterior Illumination.

The continued improvement in illuminants is reflected in the spread of outdoor lighting of all kinds, and the use of light more than ever before for a variety of purposes. Thus a real estate dealer arranges to have a new subdivision highly illuminated, and rapidly sells his lots to customers who have come out to view them at night. Improvements in distance-lighting and control have made feasible the employment of gas in places where its use had previously been considered impossible. A big extension is to be noted in the use of light for exterior advertising.

Flood-Lighting.—One of the most striking illustrations of the modern "flood-lighting" method of illuminating the exterior of buildings is to be found in the lighting of the Woolworth Building in New York City, which was disclosed to public view at the beginning of the year. It has been said that more light is provided for the illumination of the tower than is usually employed in lighting a city of 30,000 inhabitants. About 600 automobile projector units fitted with tungsten lamps are used to throw light on the structure from the thirtieth to the fifty-eighth storey. These projectors are arranged so that some throw their light upward and the rest downward. Thus there is one continuous diffusion of light over the whole surface. The lamps throwing light downward are carefully screened, so as not to be directly visible from the street. The most novel point of the installation, however, is at the sixtieth storey—called the "crow's-nest" or "lantern." It has been enclosed with diffusing glass, and within are placed twenty-four 1000-watt lamps. An automobile dimmer connected with these lamps continuously alters their intensity in an irregular cycle. Thus at one instant the glass surface of the lantern shows a deep red glow no brighter than the adjacent gilded structure, and again it flares up to a bright white light many times this brightness and visible for miles.

The flood-lighting idea has been much extended in the illumination of advertising signs on billboards, water-tanks, roofs of buildings, side walls, and elsewhere. In such cases the effect is accomplished by directing a beam of light against the sign from some nearby convenient location. A new lighting unit of high intensity utilizing a parabolic reflector has been recently developed for this special purpose.

Lighting of Sports.—The lighting of courts for tennis and other sports has proved so satisfactory that the idea is being tried in a number of different ways. A playground in a city park has been illuminated so that its various amusements are available at night as well as by day. A test was made at the Indiana State Fair grounds recently of a system of illumination, in order to try out the practicability of automobile racing at night. The result was a complete success.

Interior Illumination.

The trend in interior lighting continues to be in the direction of protecting the eyes from excessive brightness. A recently finished, and what is claimed as the largest, hotel in Europe has been fitted throughout with the semi-indirect system of illumination—the lighting so arranged that corridor lights are independent of those in adjacent bed-rooms. In the dome of the rotunda court a novel plan has been adopted of introducing opal bulls-eyes, with a lamp behind each, into the risers which support the glazing of the dome. Around the dome cornice is a ring of lamps, which are concealed from view at the floor level but throw a considerable volume of light upward into the dome. Some 6000 lamps are used in this hotel. In England the use of high-pressure gas is being extended to factory lighting.

While private enterprise is quick to see and adopt improvements in lighting sources and methods, the municipally controlled institution has in the past exhibited a decided inertia in this respect. A start has been made in Boston to remedy this; and the replacement of old types of lamps of low efficiency has already brought about a marked saving to the city. The change has been so satisfactory that one of the city engineers is to devote his entire time during this year to improving the lighting of buildings in the school, police, and fire departments.

A novel use for the method of indirect lighting is to be found in the illumination of clock dials in the new Boston Custom House. Behind each dial is a chamber with white walls illuminated by a number of lamps. Numerals of the dial are in the form of slots set in concrete, and the lights in each chamber are so arranged that no unreflected light passes through the slot. The effect is to make each numeral appear as if cut out from a piece of uniformly lighted paper.

Now that semi-indirect and totally indirect lighting systems are coming more and more into use, the effect of the walls and ceilings in reflecting light is of great importance. The results of considerable work on tests of the reflecting power of paints have been presented. The colours examined ranged from white to dark buffs and greens. The highest coefficient obtained was 0·657, which was for a white oil paint of medium gloss. Less than one-half of the samples tested showed coefficients above 50 per cent., and all of those that did so were of very light creamy or yellowish tones. A rather light colour gave only 0·328.

Reference should be made to the very important work of the Committee on Lighting Legislation and the Factory Lighting Committee of this Society, as a result of which a code on the lighting of factories, mills, and workplaces has been prepared.

Extensive Water Supply Works for Sydney.—It is stated by the Board of Trade that a report of the Chief Engineer of the Sydney Metropolitan Board on the extension of the local water supply recommends that the following works should be put in hand so as to be available by 1922: Trunk and sub-mains, to cost £1,331,212; local storage reservoirs, £366,715; pumping-stations, £450,208; amplification works, £485,540; lower canal, screening, and sedimentation works, £56,000; and new storage reservoir on Cordeaux River, £446,500.

RODUCTION OF HYDROGEN FOR WAR PURPOSES

An article by Dr. A. Sander, an engineer, of Darmstadt, in the Journal für Gasbeleuchtung" for Oct. 30 gave a history of the roduction of hydrogen for war purposes. In so far as the article as a bearing on the gas industry—either from the standpoint of ompetition of hydrogen with coal gas, or from the utilization of as-works plant for the production of hydrogen—its contents are mmarized below.

Early Military Balloons.

The first ascent in a balloon filled with hydrogen was made by e physicist Charles at Paris, in 1783, and eleven years later French aeronautical company was formed, with the physicist outelle at its head. This company proved very useful to the rench Republic in the wars which it was waging at the time ith Austria, Holland, and England; and a little later the balloon ection was of great service in the sieges of Dusseldorf, Mayence, Vorms, and Mannheim. Napoleon took a balloon company with is expedition to Egypt; but the ship carrying the balloon and as-producing plant was destroyed by the English fleet. Upon is return to Paris in 1799, Napoleon, who had little faith in the alloon section, abolished it.

The use of balloons for military purposes attracted attention in ther countries considerably later than in France. In Austria alloons were used in 1866, and by Germany in the war of 1870. The German balloon section assisted at the seige of Strassburg; ut failing to prove of service in the siege of Paris, it was disanded the same year, and not reformed till 1884. The French, owever, made much use of balloons during the siege of Paris—o less than 66 balloons, with 161 people, and about three million etters ascending from Paris between the 23rd of September, 1870, nd the 28th of January, 1871. Of these balloons, only five fell nto the hands of the German Army.

The use of airships in war has, however, become more imortant since that time. Dirigibles on many different systems are sed, not only for purposes of observation, but also for attack. The question of the production of gas for use in both naval and ilitary dirigibles has naturally grown in importance. At the resent time the captive balloon and the motor airship are praccally the only types of balloons for which gas is required.

Captive Balloons.

Almost all modern armies use captive balloons of the type contructed by Parseval and Sigsfeld in 1893-97. It is a cylindrical alloon, which sets at an incline against the wind like a kite, and ontains 21,000 to 26,500 cubic feet of gas. It is anchored by a teel-wire rope wound by a windlass worked by hand or engine. t is used at a height of about 2600 feet—the observer having telehonic communication with the ground. The observer's vision vith the naked eye, in clear weather, extends to about 12 miles. To get the best service from the captive balloon, it must be posible to fill and make it ready to ascend in the shortest possible ime; and it is in this connection that the question of the gas upply becomes of such significance. In the earliest days of Coutelle, the only process for making hydrogen was by the action f dilute sulphuric acid on iron. Coutelle was impelled to seek nother method of manufacture, because at that time sulphuric cid was produced exclusively from sulphur, and the available upplies in time of war were required for the manufacture of gunowder. Coutelle took advantage of Lavoisier's observation that team passed over incandescent iron yielded hydrogen; and he roduced a plant, consisting of retorts charged with iron turnings nd heated by wood fires, in which hydrogen was made for chargng balloons. The production was, however, slow; the plant was ot readily portable; and the retorts were liable to crack. Return vas consequently made to the acid process; and the German balloon section in 1870 used at Strassburg a plant consisting of 75 wine casks—60 of which were employed as gas producers, 12 s washers for the hot gas, and 3 as driers. With this plant an bservation balloon was charged in five hours; but it was primiive, clumsy, and ill-adapted for field requirements. In the war of 1870 the French devoted serious attention to the production of ydrogen, and constructed the first portable hydrogen producer, which used the iron and sulphuric acid process. One of the most ecent modifications of this plant is that of Godard, in which a waggon carries two iron hydrogen producers coated inside with ead, a washer, a drier, and a small pump, which feeds the producers with acid and the washer with cold water. The diluted acid is continuously pumped in an upward direction through the two producers charged with iron filings. About 250 lbs. of iron and 500 lbs. of sulphuric acid are required for the production of 1000 cubic feet of hydrogen. A waggon capable of producing 5300 cubic feet per hour weighs a little over 2 tons. About 7 tons of materials are required for charging a balloon of 21,000 cubic feet capacity.

Compressed Hydrogen.

In the eighties a process for producing hydrogen from dry materials was worked out by Majert and Richter. It was based on the fact that a mixture of zinc dust and slaked lime gives off hydrogen when heated to redness. A portable apparatus on this principle was constructed, which was used by the Prussian balloon section. Two or three hours were required to fill a balloon with this apparatus, whereas the military authorities considered that, in order to use captive balloons to full advantage, it must be possible to fill them in less than half-an-hour. In order to achieve this, the manufacture of hydrogen on the spot was given up, and hydrogen compressed in steel cylinders was carried on waggons. This method was first used in 1885 by the English expedition to the Soudan. In this case, two cylinders formed the load of a camel. The Italians employed the same method in their campaign against Abyssinia in 1887; and it has since been adopted by almost all armies. The cylinders first used by the English were 7·9 feet in length, and weighed about 66 lbs. Their volume was about 1·13 cubic feet; and hence, at a pressure of 120 atmospheres, they yielded about 141 cubic feet of gas. The cylinders now used in the German army are of heavier construction; have a volume of 1·27 cubic feet; and, at a pressure of from 130 to 150 atmospheres, they contain about 177 cubic feet of gas. Thus about 120 cylinders are needed to fill one captive balloon. The waggons used for transport are limbers, carrying twenty cylinders, and drawn by four horses. Twelve of these waggons are attached to a German balloon section—thus providing for filling one captive balloon twice. As a result of careful training, the men are able to get a balloon filled and ready for ascent in fifteen to twenty minutes. The whole of the cylinders of six waggons are connected to a single pipe; and the valves of the cylinders are opened without removing them from the waggons. Special motor and railway waggons are also provided for the transport of gas cylinders. The waggons used in the French army are entirely different from the German. They are not limbers but four-wheeled waggons carrying six cylinders, each containing 880 cubic feet of gas. The cylinders are, therefore, five times as large as the German, and the waggons require six horses to draw them. The German waggons surpass the French in mobility.

Portable Hydrogen Generators.

Portable hydrogen producers have, however, been retained in many armies for use in mountainous districts with bad roads, or at a distance from railways. The Russian army in the war with Japan in 1904 introduced portable apparatus depending on the action of aluminium on caustic soda solution. The action is very vigorous, and much heat is developed. Consequently, the process is only applicable where there are ample supplies of cooling water. About 343 lbs. of materials are required to produce 1000 cubic feet of hydrogen by this process. A similar process was used by the Spanish aeronauts in the Morocco campaign. This depended on the action of silicon on a solution of caustic soda. The reaction takes place very vigorously at 176° to 194° Fahr., which temperature is provided by the heat of solution of the caustic soda in water. For the production of 1000 cubic feet of hydrogen by this process 125 lbs. of material are required. The apparatus, which is very light, is used in large numbers by the German, Austro-Hungarian, Italian, and Spanish balloon companies. A very similar process has been adopted by the French—under the name of the "Silikol" process—in which, in place of pure silicon, a ferro-silicon containing a high percentage of silicon is treated with 35 to 40 per cent. solution of soda. The materials to produce 1000 cubic feet of gas by this process weigh only 119 lbs.

These processes, however, require considerable quantities of water for cooling purposes; and the French "Hydrogenite" process has been devised for use where very little water is available. The material used is a mixture of finely ground ferro-silicon and soda-lime. This material ignites easily and, on exclusion of air, burns readily and develops a large quantity of hydrogen. The mixed material keeps for an unlimited length of time at ordinary temperatures—187 lbs. of it yielding 1000 cubic feet of hydrogen of a very high degree of purity. The material is put up in blocks in air-tight cases containing 56 lbs. The generator in which the blocks are used is surrounded with a water jacket. The heat of the reaction evaporates the water; and towards the end of the combustion of the material the steam produced is introduced into the generator, thereby increasing the yield of gas and extinguishing the material.

Calcium hydride has also for some years been used in France, under the name of "Hydrolith," for producing hydrogen for military purposes. Calcium hydride is manufactured by passing hydrogen into molten calcium. The hydride is therefore, in a sense, a hydrogen accumulator, as the hydrogen used can be produced by any process, and stored in the metallic calcium for use at any time. It is evolved immediately the hydride is brought in contact with water. The excessive evolution of heat which takes place on the decomposition of the hydride by water at first caused great difficulties, which were overcome by the French chemist Jaubert, in an apparatus of very ingenious construction. A portable hydrogen generator using this process constructed at the military balloon factory at Chalais-Meudon gave the extraordinarily high output of 56,480 cubic feet of hydrogen per hour. This plant, with a store of 20 tons of calcium hydride, will yield 692,000 cubic feet of hydrogen, and has given excellent results. The price of calcium hydride is, however, high.

Several years ago Maurichau-Beaupré recommended activated aluminium as a raw material for producing hydrogen; but he activated it by means of the poisonous materials potassium cyanide and corrosive sublimate. The Griesheim-Elektron works has succeeded in producing aluminium of nearly equal productive capacity by the addition of about 1 per cent. of caustic soda and 1 per cent. of mercuric oxide. This preparation is less poisonous; and, on interaction with water. 52 to 62 lbs. yield 1000 cubic feet of hydrogen.

Stationary Hydrogen Generators.

In regard to fixed or stationary plants for the production of hydrogen, an important condition is that they should have a high output of gas per hour, in order to make good in the shortest possible time the loss of gas which takes place in the normal working of an airship. Numerous processes are employed. The early processes, depending on the action of sulphuric acid on iron, have now been entirely superseded. In the nineties, the electrolytic water-decomposition process was introduced. It yields a very pure gas, and requires little attention. Apparatus for this process is made by the Schuckert works at Nuremberg, and the Oerlikon works, near Zürich, in which alkaline electrolyte and iron electrodes are used. Two plants of the Schuckert type were erected at Strassburg and Metz—each capable of producing 1765 cubic feet of hydrogen per hour. The Oerlikon plant requires less space than the Schuckert plant, and yields 1000 cubic feet of hydrogen by the expenditure of 212 B.T.U. of current. The Oerlikon apparatus is used at the military airship station at Farnborough and by the Swedish and Russian navies, which have balloon ships provided with this plant, compressors, and steel cylinders, for coast defence purposes. Their captive balloons facilitate the detection of submarines and mines.

Utilization of Water Gas.

Coutelle's old process of the action of steam on incandescent iron has been re-introduced in recent years. The International Hydrogen Company, of Berlin, employs this process—producing iron as a suitable porous sponge by the reduction of pyrites residues by water gas. The sponge is acted on by steam when heated to about 1470° Fahr. The ferric oxide produced is again reduced to iron by water gas. At first, horizontal iron retorts were used for the process; but, as their durability was small, the "B.A.M.A.G." Company, which has absorbed the International Hydrogen Company, has recently employed fire-brick vertical retorts. In order to maintain the iron at the temperature requisite for the reaction, water gas is burned in the vertical retorts at fixed intervals, whereas with the older retorts the heating was external. The process is therefore divided into three periods—(1) heating up; (2) reducing; (3) gas producing. The hydrogen made contains only 1 to 2 per cent. of impurities, and 1000 cubic feet cost about 3s. 5d. The older form of this process was, until recently, in use in the fortress at Cologne, where there was an installation of 5650 cubic feet per hour productive capacity. The Austrian Airship Station at Fischamend, near Vienna, also used it. The installation there is so arranged that it can be used also for a similar process devised by Professor Strache, of Vienna.

A noteworthy improvement of the process is embodied in the hydrogen producer constructed by Dr. Messerschmidt. His apparatus consists of a vertical chamber lined with firebrick, from the top of which an iron cylinder is suspended, while a second smaller iron cylinder, resting on the bottom of the producer, passes up within the first iron cylinder. The annular space between these two cylinders is packed with iron ore. The interior of the producer is filled with fire-clay chequer-work. The water gas, mixed with a limited proportion of air, is admitted at the bottom of the producer, and passing upwards through the middle cylinder heats the chequer-work in it. It then passes down through the iron oxide, reducing it to metallic iron, and at the same time heating it, and finally passes upwards through the outer space in the producer, where the unburned gas is consumed by a secondary supply of air. The exterior firebrick chequer-work is thus raised to the reaction temperature of 1290° to 1470° Fahr. The construction renders very uniform heating of the iron oxide possible, and utilizes most thoroughly the heat of the reducing gas. The heating and reduction process terminates in about twenty minutes, and steam is then introduced. For a few seconds, it is allowed to sweep the heating gases from the producer, and then the production of hydrogen commences—the steam being introduced at the top in the outer part of the generator. It then passes up through the incandescent iron, which decomposes it. The hydrogen formed travels through a hydraulic main and is cooled and purified in the usual way. The gas-making period, or "run," lasts about ten minutes; and the heating-up and reduction of the iron oxide is then repeated. The plant is adapted either for continuous working or for intermittent use, as the producer can be heated up from the cold in a few hours. The only attendance required is observation of the temperature on a pyrometer and the changing-over of the control levers. There is automatic locking of the latter to prevent improper operating of the valves. A water-gas plant of ordinary construction is a necessary accessory. Plants on the Messerschmidt system, as made by the Carl Francke Hydrogen Company, of Bremen, have been erected at the Zeppelin yard at Friedrichshafen, at the fortresses at Cologne and Königsberg, and in a number of military airship stations. The gas produced by this process contains 98·5 per cent. of real hydrogen; and the cost of manufacture is low.

Utilization of Oil Gas.

Another process, worked out by the Dutchmen Rincker and Wolter, starts with oil gas, which is led through a generator filled with incandescent coke, in which it is so thoroughly decomposed that the hydrocarbons are split up into carbon and hydrogen. This process was at use at Königsberg until a short time ago; and the Russian Balloon Sections use this type of plant mounted on two railway waggons. The first waggon carries two generators, a blower, and an oil tank with pumps; while the second waggon carries the purifying plant. The generators are first blown hot by the air-blast; and then a certain quantity of oil is injected, gasified, and decomposed. The hydrogen thus formed is exhausted from the bottom of the generator. It contains 2 to 3 per cent. of carbonic oxide, which is removed by passing over heated soda lime. The plant produces 3500 cubic feet of hydrogen per hour. The only raw materials are coke and oil, which may be either crude petroleum or petroleum residues, tar, benzol, or benzoline. Two men are required to attend to the plant, and the cost of manufacture is from 2s. 6d. to 4s. per 1000 cubic feet. The plant being comparatively readily portable, can be used not only in military establishments, but to follow an airship so that, when the latter lands, the plant can quickly supply the gas required to refill it.

In addition to the processes already mentioned, there are others suitable for large stationary installations. Thus the silicon process of the Schuckert firm is used at the fortress of Mayence, by the Swiss, and for the Italian airships at Bracciano. These stationary plants have a productive capacity of some 10,600 cubic feet per hour. Almost all the French fortresses on the eastern frontier are provided with large hydrogen plants on Jaubert's analogous "Silikol" process.

In conclusion, it is pointed out that there are now large hydrogen plants at many chemical works, oil factories, ship-yards, and electric lamp works. All these plants could, in case of need, be used for producing hydrogen for military purposes. It will here suffice to mention the Griesheim-Elektron works, near Frankfort-on-the-Maine, which has done a great deal in developing airship travel in Germany. At this works large quantities of hydrogen are produced every day as a bye-product in the electrolysis of potassium chloride and of sodium chloride. The development of a large number of different processes for the manufacture of hydrogen within the last twenty years has been stimulated by the requirements of the airship service; but, on the other hand, the latter has gained much from active co-operation by the chemical industry.

Output of Benzol by Bye-Product Coke-Ovens.—Speaking at a recent meeting of the Engineer's Society of Western Pennsylvania, Dr. H. C. Porter, the Chemist of the United States Bureau of Mines, said that American bye-product coke-ovens were expected to be producing before the end of this year about 25 million gallons of crude benzol or light oil annually—an increase of 150 per cent. in about a year, due to war conditions. The quantity necessary to make all the dyes and refined coal-tar chemicals (except explosives) used in the United States is not more than 5 million gallons a year.

Wages of Prisoners of War on German Gas-Works.—It will be remembered that in the report of the proceedings at the annual meeting of the German Association of Gas and Water Engineers on the 30th of June last, it was mentioned that Herr Martin, the Manager of the Erfurt Gas-Works, stated that prisoners of war employed on German gas-works received wages which, after all deductions had been made, amounted to 7½d. per week. Herr Martin has pointed out in the "Journal für Gasbeleuchtung" of the 30th ult. that he was incorrectly reported in the official account of the proceedings, and that he actually stated that the pay of prisoners, after deductions had been made, amounted to 7½d. a day.

Dye Industry in Japan.—It has been decided by the Department of Agriculture and Commerce of Japan to establish a Company for the manufacture of dyes. There are to be factories in Tokio, Osaka, and Fukuoka. Shareholders must be officials of gas companies or of companies engaged in the manufacture of chemicals, medicines, and perfumery, and other private business men. The Department will place 2400 tons of benzol produced at the Government steel works at the disposal of the Company for the regulation of the price of materials for the manufacture of dyestuffs, and will guarantee a profit of 8 per cent. per annum for ten years from the date of the establishment of the concern. The methods of calculating the profit, and the amount of subsidy.to be given by the Government, are to be determined.

Extraction of Sulphur and Cyanogen with Potash Carbonate.—A recent issue of "Het Gas" contains a statement of the claims made by Heer Th. Petit for a patented method of extraction of sulphur and cyanogen with a lye of potash carbonate used in a rotary washer, or rather two washers—one serving for the revivification of the liquor which has been saturated in the first. According to Heer Petit, the first reaction consists in the formation of bicarbonate by carbonic acid in the gas. Hydrogen sulphide is then fixed as hydrosulphide of potash and hydrocyanic acid as potassium cyanide. These compounds, Heer Petit seems to claim, are dissociated by passing air through the saturated liquor, discharging hydrogen sulphide and hydrocyanic acid, and regenerating the potassium carbonate. The working of the plant is controlled very simply by the use of lead test-paper. The changes assumed to take place in the two washers are represented by conventional chemical equations which are illustrative rather than in conformity with the complex conditions of practice. In all such processes of wet purification, which form the subject of many patent specifications, it is more pertinent to know the results of measurements upon a working or even a laboratory scale.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Price of London Pitch.

With reference to the letter of Messrs. Blagden, Waugh, and Co., blished in our last issue, our reporter on the London market states t he has seen certain contract notes relating to transactions indi- ed in reports dated Sept. 6 and Oct. 4, as establishing the price of . net per ton at makers' works. They are *bonâ-fide* contracts, and in aggregate amount to several thousands of tons of pitch, while the price is correctly represented.

The manufacturers who made the sales during August and Septem- naturally decline to satisfy the curiosity of Messrs. Blagden, augh, and Co., by showing them the contracts; but our reporter is mitted to say that the risks of high freight do not concern the lers, who moreover have not been caught napping by the rates of eign exchange.

As these transactions appear to be the only important sales of London ch mentioned for the months of August and September, it would m that the price recorded held the field.

During October the price drooped; but Messrs. Blagden, Waugh, l Co., are not justified in putting the average price for September l October at 20s. per ton, although that price may have been the nimum export figure in the latter month.

But, in reporting values, some regard has to be given to the fact that naterial proportion of the British production of pitch—including that nufactured in the neighbourhood of London—is used in this country, l commands a higher figure than the current export price. It would, refore, not be fair to the tar producer to ignore sales for home use fixing prices.

With reference to the interesting point raised by Messrs. Blagden, augh, and Co., who submit that London prices should be based on nsactions on London terms, our reporter maintains that such a view much too narrow. It is immaterial to the validity of a transaction ether the buyer is in London or abroad. Sales to foreign buyers always be brought to a London price by deducting the actual ex- nses (if any) beyond f.o.b. makers' works.

* * *

Who was the Originator of the Sliding Scale?

SIR,—With reference to the recent remarks on the above, I venture submit that the sliding scale originally saw the light of day in the effield Gas Act of 1866 and the West Ham Gas Act of 1869, varying rate of dividend from 7 to 10 per cent. according to the price charged. 1874, Sir (then Mr.) George Livesey, gave, in an address to the British sociation of Gas Managers, an outline of an unlimited up-and-down ling scale which was the principle adopted by the Board of Trade their letter to Mr. Forster's Committee on the 1st of June, 1875 aling with the Metropolis Gas Companies Bill), and which was sup- rted by Mr. Livesey as a witness attending by Speaker's order at instance of the Metropolitan Board of Works. Mr. Cripps, who peared on behalf of the promoters (the Corporation of London and Metropolitan Board of Works), then asked for an adjourment, l a few days later submitted the following statement:

> "The promoters of the Metropolis Gas Companies Bill having regard to the expression of opinion of the Committee to which the Bill has been referred, and being strongly impressed . . . are willing to insert in the Bill a clause regulating the supply of gas by a sliding scale of price and dividend, as suggested in the Board of Trade letter of the 31st of May, 1875."

should say that the 1875 sliding scale is that which has operated in nciple up to to-day; and there appears no doubt in this form but that George Livesey was its originator.

R. W. EDWARDS.

ldershot, Nov. 23, 1915.

he foregoing letter recalls an interesting passage in a speech by Mr. H. E. Jones at the meeting of the Wandsworth, Wimbledon, and Epsom District Gas Company on Feb. 23 last—see "JOURNAL," March 2, p. 536, second column. It reads: "Mentioning that he was a pioneer in 1875, in connection with the Commercial Gas Company, in adopting the sliding-scale proposed by Sir George Livesey, he added as a point of interest that, as early as 1864, he had a sliding-scale clause put into the Watford Gas Company's Act.—ED. J.G.L.]

* * *

Storage of Ammoniacal Liquor.

SIR,—The article by Mr. W. S. Curphey, the Chief Inspector of ali Works, together with your "leader" upon it, arrives at an portant time, when gas-works residuals are receiving closer attention n ever before.

The loss of ammonia from storage tanks and other receptacles is en enormous. In many gas-works little care is taken to cover all nholes, boshes, syphons, and seal-pots generally; while in some es open tops are advocated. A blue tint around everything in the inity is proof of the loss occasioned.

n the "JOURNAL" for Jan. 23, 1900 [Vol. LXXV., p. 209], you pub- ned a communication from me upon the subject; and in the same ume, pp. 398-9, you inserted an article dealing with the whole ques- n, in which it was advocated that everything about the storage of uor should be closed.

Now that so eminent an authority as the Chief Inspector has revived matter, it is likely (and rightly so) to receive the full attention it rits.

EDWARD A. HARMAN.

5, *New Street, Huddersfield,*
Nov. 25, 1915.

Canadian Calorific Standard.

SIR,—Permit me to correct the statement contained in an "Editorial" in your issue of Oct. 26, in which it is said that the new gas regulations "were framed by the chief officials of the Inland Revenue Department in collaboration with the Executive Committee of the Canadian Gas Association."

It may be stated that there was no such collaboration. It is true that early in the year 1914, the Executive of the Association waited on the Minister of Inland Revenue with the request that a calorific standard of 500 B.Th.U. be established. This request was not granted, nor was that of certain Utility Commissions asking that a standard of 600 B.Th.U. be fixed. Later the Executive Committee was asked to give its adherence to a standard of 520 B.Th.U. without allowances, which it did, and worked for its final adoption. Beyond this, the Association had no part in the framing of the regulations.

ORMOND HIGMAN, Chief Engineer.

Electrical Standards Laboratory, Ottawa,
Nov. 10, 1915.

[We are pleased to have the correction from Mr. Higman. The idea as to collaboration was obtained from the following passages taken from the report of the Executive Committee of the Canadian Gas Association: "The most important work of your Executive during the year was in connection with the new Inland Revenue Department Regulations for Gas Testing. A Sub-Committee, consisting of Mr. Mann, the President, Mr. Norris, Mr. Hewitt, and Mr. Dion, interviewed the Chief Gas and Electric Inspector in Ottawa in December, and discussed further the proposed new calorific power standard—a subject that you will remember was discussed in open convention at the Ottawa meeting last year before the Deputy-Minister of Inland Revenue and Mr. Lambe, the Chief Inspector of the Eastern Division. Your Executive are gratified to report that, as a result of the Special Committee's interview, the new standard of calorific power, since put into operation throughout Canada, *was agreed upon between the Department of Inland Revenue and the representatives of this Association.*" Then in the address of the President of the Association (Mr. H. E. Mann), he remarked: "By the adoption of this calorific standard, the Canadian Gas Association has secured for the gas companies of the Dominion an equitable standard." We think our interpretation of these statements was not unjustified.—ED. J.G.L.]

* * *

Imported Incandescent Gas-Mantles.

SIR,—With reference to the letter from Mr. F. D. Marshall, under the heading of "Imported Incandescent Gas-Mantles," which appeared in your issue of the 23rd inst., we should like to call your attention to the words at the beginning of the third paragraph, reading as follows:

> "When I refer to British-made mantles, it is, of course, understood that manufacturers in this country are practically dependent for all the high-quality raw material, and for the matter of that for the necessary apparatus, on the Germans."

We do not intend to be drawn into any paper controversy, but wish to state that, as far as we are concerned, if Mr. Marshall's letter had read that manufacturers "were" dependent, instead of "are" dependent, he might have been more correct.

We are now in the position either to manufacture ourselves or to procure in this country from British manufacturers all the raw materials and machinery we require for the manufacture of our incandescent gas-mantles; so that we do not rely in the least degree upon the Germans.

CURTIS'S AND HARVEY, LTD.,
per E. D. METCALFE, Secretary.

Cannon Street House, E.C., Nov. 24, 1915.

[Since Mr. Marshall's letter was received we have seen in this country a very large building which is being devoted to the production of thorium nitrate.—ED. J.G.L.]

* * *

Creosote Prices.

SIR,—With reference to the figures quoted by your London correspondent, of 4d. and 4½d. for creosote during the past few months, we are aware that business has been done at 4d. for shipment to America, but the quantity is in lots of about one million gallons; and, as it is difficult to secure tonnage, not many consignments have gone forward. During this period we have been freely selling at 3½d., f.a.s. London.

We have a number of tar contracts based on the price of creosote in London; and we think that it would be more equitable to quote the price for home trade in addition to the export one.

THOMAS CLAYTON (OLDBURY) LTD.
per FORRESTER CLAYTON, Director.

Brentford, Nov. 23, 1915.

Prepayment Meters and Copper Coinage.—Referring at the meeting of the Middlesbrough Gas Committee last Tuesday to a circular from the Controller of the Mint suggesting, in view of the shortage in copper coinage, more frequent collections from the slot-meters, the Chairman (Mr. J. Calvert) pointed out that collections were now made with greater frequency than in most towns. It was proposed that some of the meter inspectors should be released in order to enlist, and that women should take their places; but the Chairman observed that women could not do the same amount of work as men, as there was such a quantity of copper to be carried. The Committee approved the principle of releasing the men; leaving it to the Manager (Mr. David Terrace) to re-arrange the duties.

PARLIAMENTARY INTELLIGENCE.

NOTICES GIVEN FOR BILLS (SESSION 1916) RELATING TO GAS AND WATER SUPPLY.

Aberdare and Aberaman Gas.—This Bill is for the purpose of consolidating and converting the capital of the Aberdare and Aberaman Consumers' Gas Company, to confer additional capital and borrowing powers; to allow of the creation of special purposes and other funds; and to apply the sliding-scale. Provisions are also inserted to empower the Company to purchase by agreement the undertaking of the Hirwain Gas and Coke Consumers' Company, Limited; to extend the limits of supply; to substitute a calorific value standard for the illuminating power test; to amend the obligations of the Company as to giving a supply of gas where a supply for any other purposes than lighting or domestic use would interfere with the efficiency of the gas for lighting purposes; to establish a profit-sharing scheme; to enable the Company to make superannuation and other allowances, and pay pensions, to officers and servants; and to manufacture gas and deal with residual products on certain land.

Beighton and District Gas.—Dissolution and re-incorporation is desired by the Beighton and District Gas Company, Limited; the new Company to be authorized to carry on the undertaking within the limits of the parishes or townships of Beighton, Aston-cum-Aughton and Ulley, and Wales. Provision will be made in regard to the capital and borrowing powers of the Company.

Burnley Water.—An extension of time for the completion of the Hurstwood reservoir and other works authorized by their Act of 1908 is to be sought by the Burnley Corporation, as well as power to reduce the rates of charge for water for various purposes. Further borrowing powers are needed, and the suspension, for a period to be determined, of sinking-fund payments.

Colchester Gas.—It was stated last week [p. 444] that the Colchester Gas Company will ask Parliament to alter, extend, or limit and define their powers with regard to the purchase of residual products. They also desire an extension of their area of supply, and to raise further capital, as well as to work under a calorific standard and the sliding-scale.

Ferndale Gas.—The Ferndale Gas Company, Limited, as notified in the last issue of the "JOURNAL" [p. 444], intend to apply for an amendment of their Order of 1883. They require further capital and borrowing powers, provision for various funds, &c.

Folkestone Gas.—The Folkestone Gas Company are proposing to acquire the undertaking of the Hythe and Sandgate Gas Company; and they will ask for the necessary powers to carry the scheme into effect. An extension of the limits of supply is sought, and the transfer to the Company of the undertaking authorized by the Elham Valley Gas Order of 1912. Provision is to be made for the taking over of all or any of the officers and servants of the Hythe Company, and the compensation of those removed from office, and of the Directors and Auditors. The Company will ask to be relieved from obligations and restrictions in the matter of illuminating power and sulphur compounds, and to work under a standard of calorific value; also for the application to the amalgamated capital, and any new capital, of the sliding-scale, either with or without a neutral zone. Additional capital is wanted, as well as authority to create a special purposes fund and a benefit and superannuation fund.

Hornsey Gas.—The Hornsey Gas Company will ask to have defined the boundaries of their limits of supply and those of the Gas Light and Coke Company as regards the parish of Hornsey. They also desire power, upon lands now belonging to them on which they are authorized to manufacture or store gas, to deal with and store residuals; and to establish pension, special purposes, and other funds.

Imperial Continental Gas Association.—The Imperial Continental Gas Association will ask leave to bring in a Bill to remove doubts as to their powers in various respects connected with the carrying on of the business of the undertaking; to sanction and confirm certain distributions of funds by way of dividend; and to issue ordinary and preference stock at less than the nominal amount. The Bill will include various provisions relating to debenture stock, and will ask for authority to hold one ordinary meeting only in any year. There will also be proposals affecting the number, qualification, &c., of Directors.

Newcastle and Gateshead Gas.—Mention has already been made [*ante*, p. 444] of the intention of the Newcastle-upon-Tyne and Gateshead Gas Company to seek power to extend their limits of supply; to substitute a calorific power test for the illuminating standard; to work-up, convert, and utilize residual products, and purchase such products from other gas undertakers; and to raise further capital.

Northwich Gas.—Power will be sought by the Northwich Urban District Council to acquire the undertaking of the Northwich Gas Company, under the terms of the Northwich Gas Act, 1915. It is proposed to hold over the arbitration to determine the price to be paid until after the war.

Plymouth and Stonehouse Gas.—Reference to the Bill to be promoted by the Plymouth and Stonehouse Gas Company was made last week [p. 444]. It is to enable the Company to carry on the business of tar distillers by acquiring the works of the late T. H. Harvey, and to enter into agreements in this connection with other undertakings in Devon and Cornwall. The calorific power test is asked for, and leave to raise additional capital.

South Metropolitan Gas.—Notice is given by the South Metropolitan Gas Company of their intention to apply for leave to introduce a Bill to declare and (if and so far as may be deemed necessary or expedient) to ratify and confirm the respective amounts of the ordinary stock and of the debenture stock of the Company as now existing; to repeal all or some of the unexercised powers of the Company of issuing ordinary capital and of raising money by the creation and issue of debenture stock; to authorize them to raise additional capital; to give them power to issue redeemable preferred stock and debenture stock; and to repeal or amend provisions relating to the proportion to be maintained between ordinary and debenture stock. They will further ask for the removal of the restrictions upon the offer of unissued ordinary stock for sale at a price less than the nominal amount of such stock; the amendment of the provisions as to the minimum price at which stock to be issued may be offered to consumers and persons in the employ of the Company, so as to permit of the making of such offers at a price below the average market price of the stock by such amount exceeding 5 per cent. as may be specified in the Bill; the alteration of the prescribed mode of ascertaining the average market price of the Company's stock; and the alteration or amendment of the mode of disposal of stock.

Tynemouth Corporation.—Among other powers, the Tynemouth Corporation wish for an enlargement of the area in which they are authorized to supply water, and to add to it the urban district of Ashington. The proposal is to purchase from the Ashington Urban District Council the Ashington Coal Company, the Duke of Portland, and the Milburn Estates, the mains, pipes, and fittings belonging to them, and to construct a service reservoir, impound certain water, and lay a number of pipe-lines.

Uxbridge Gas.—By a Bill which the Uxbridge Gas Company are promoting, they provide for acquiring the undertaking of the Eton Gas Company [see *ante*, p. 444].

Wakefield Water.—Authority is desired by the Wakefield Corporation to abandon certain reservoirs set out in their Act of 1889; to construct reservoirs, conduits, and other works in the township and urban district of Rishworth; to impound certain water; to alter existing provisions with regard to compensation water; and to further extend the time-limit of the 1889 Act for the carrying out of certain works. The financial provisions include a clause to enable the Corporation, instead of exercising borrowing powers they possess by the issue of a fresh security, to raise the money by utilizing any sinking fund established by them.

Yeadon Water.—The Yeadon Water-Works Company notify their intention to ask for powers, among other things, to acquire additional lands and streams on Hawksworth and Burley Moors; to enlarge the existing Reva reservoir at Hawksworth; to erect a service tank on Billing Hill, Rawdon, for the purpose of supplying the higher portions of Rawdon township; to repeal the obligations to supply the Baildon Urban District Council; and to extend the limits within which the Company are authorized to supply water so as to include the parish of Hawksworth and the township of Guiseley—the latter subject to an agreement being arrived at with the Guiseley Water Company. Power to raise additional capital is also asked for.

Board of Trade Provisional Order.

Fleetwood Gas.—It is intended by the Fleetwood Gas Company to apply to the Board of Trade, in pursuance of the Gas and Water Works Facilities Act, for a Provisional Order to amend so much of the Fleetwood Gas Act, 1912, as limits or restricts the amount of interest to be paid on borrowed money, and to authorize the Company to pay a higher rate of interest on borrowed money than that prescribed by the Act. The Company wish to be relieved from the obligation to give a supply of gas for any purpose other than lighting or domestic use, in cases where the capacity of the main is insufficient for such purpose, or if such supply would interfere with the sufficiency of gas required to be supplied by means of such main for lighting purposes, and to be authorized to levy and recover charges for, or in respect of, the reading of meters.

HOUSE OF COMMONS.

Peat Gas Bye-Products.

Last Tuesday Mr. BOLAND asked the Vice-President of the Department of Agriculture (Ireland) whether he had brought to the notice of the Minister of Munitions the results of researches into the valuable bye-products of peat-gas producers, and whether he would take steps to secure, in concert with the Ministry of Munitions, an extension of the manufacturing plants in Ireland in which peat-gas producers are used, and thereby obtain for Irish agricultural purposes an increased supply of a valuable nitrogenous fertilizer?

Mr. BIRRELL (Chief Secretary for Ireland) stated that the answer to the first part of the question was in the negative. The Department would be glad to bring under the notice of the Ministry of Munitions the researches referred to, which, in his opinion, were well worthy of attention.

Award in a Sydney Gas Strike.—Mr. J. B. Holme, Under Secretary for Labour and Industry, has had before him for arbitration the facts with regard to a recent strike of gas employees at North Sydney, owing to the suspension of a trimmer for refusing to assist the foreman when storm-waters were flooding the furnace cellars, on the ground that he was engaged only to truck and trim coke. Mr. Holme, in giving his decision, says he finds, without the slightest hesitation, that the Company's position in the matter is entirely vitiated by the fact that the man in question was not immediately suspended by the foreman when he refused, as the foreman supposed, to do work which became necessary in a grave emergency for the purpose of preserving the Company's property. The foreman was also entirely at fault in not explaining to the man, when he refused to do work other than he had contracted to do, that the work had become necessary by reason of the occurrence of a grave emergency. The punishment imposed upon the man was unjust.

LEGAL INTELLIGENCE.

GAS-WORKS AND LIGHTING RESTRICTIONS.

Another case of an alleged infringement at a gas-works of the Lighting Order was heard last Saturday week, when, at St. Augustine's Petty Sessions, Mr. C. V. Bennett, the Manager of the Herne Bay Gas-Works, was summoned for having failed to effectively shade the pening leading into the retort-house, so that no bright light was shed utside. Superintendent Heard said that when he called attention to he emission of light, and the need for shading the aperture, Mr. Bennett remarked that the men could not be suffocated. Witness, owever, suggested that sail-cloth, or something of the kind, could be ut outside the aperture, and that 2 feet or so at the bottom could be left open to admit air. Later, on visiting the works, he found that what he had suggested, or nearly so, had been carried out, and that the light was now effectually shaded. Mr. Bennett conducted his own case, and on cross-examination by him witness said there was a wall which screened he actual source of the light, which was the retorts; but there was a glow that was visible from the outside. He was aware the retort-house had only one entrance. Previous to this matter, Mr. Bennett had done all that he had asked him to do. Ventilator masks had now been put up. Mr. Bennett gave evidence on his own behalf, and said he had elucidated from the witnesses that, whereas the information was that a bright light was exhibited, they could not give him a definition of brightness. He submitted that until they could prove that, and that he definition could be given in order to prove it, this part of the information failed. In the second place, the evidence had proved that this ight was not seen from the outside of the Company's premises. The Superintendent said the brightness was not seen outside, but only on he premises. Moreover, the reason why the Superintendent did not ee the light, whether it was bright or otherwise, was, of course, beause a wall belonging to the Company hid it from his view; and he contended this constituted a screen to the light. He should contend that a glow was not a bright light. He was most anxious to comply with any reasonable request; and after the Superintendent's first call he (Mr. Bennett) spent much time considering how to deal with the important problem of ventilation which was involved. The Chairman said he knew that Mr. Bennett, as the Company's Manager, was, as a rule, anxious to conform to the law in every respect; but there had been a decided breach in this case, and he must therefore pay a fine of £2.

Mr. Fred. Hotchkin, the Manager of the Arlesey (Beds.) Gas-Works, has also been fined £2 for failing to comply with the order. Bright ights were seen; and defendant, who had previously been warned, admitted his negligence.

MISCELLANEOUS NEWS.

ORIENTAL GAS COMPANY, LIMITED.

The Ordinary General Meeting of the Company was held last Wednesday, at the Company's Office, Finsbury House, Blomfield Street, E.C.—Mr. H. D. Ellis in the chair.

The Secretary (Mr. H. J. Luff) read the notice convening the meeting; and the Directors' report and the accounts were taken as read—see *ante*, p. 399. The Auditors' certificate was read.

The War and Trading in India.

The Chairman said, according to his usual practice, he would offer a few remarks before submitting the report and the accounts to the meeting. In the second paragraph of the report, the Board gave an outline of the position of affairs which had been created by the war; but he thought he might be allowed, and perhaps the proprietors might expect him, to fill in, to a certain extent, this outline with a few salient details, and so give the proprietors a closer view of the actual position, and of what had transpired since last they met. At the meeting a year ago, he pointed out that, having regard to the widespread area of hostilities, they could not expect that India would altogether enjoy immunity from loss and suffering. Moreover, since then, the area of war had been considerably extended. For instance, the Mesopotamia operations had now brought the din of battle closer to the ears of India; and even now—at this moment—they were prepared to learn that more nations, neutral hitherto, had resolved to come in as combatants, and range themselves either on the side of this country and her Allies or against them. Thus the condition of unrest which had threatened their peaceful trade had been aggravated and intensified; and his forecast of trouble—not a very hazardous one—had been realized. Trade and commerce had been very hard hit. The great markets for sugar, rice, piece goods, metals, and all manufactured articles had been much depressed. The effect was shown by the diminution of land-revenue, customs, and railway traffics, and some projected railway extensions had had to be either temporarily abandoned or postponed for a while. He might go on further, but time would fail him, to elaborate this theme completely; and he would only dwell for a moment upon one factor—a very potent factor for mischief—which had attracted much public attention. He referred to the depredations of the German warship *Emden*. Well supplied, he supposed, from shore with wireless information as to outward clearances and sailings, the *Emden* was able to intercept vessels at calculated points with what he might call diabolical precision. Coupled with this, there was also the bombardment of Madras by the *Emden*, which created something like a panic among the less warlike of the Indian population of Calcutta; and they fled to the interior. Now of these good people, the Marwaris, he believed, were the middle men of the piece goods and other very important trades; and these trades were practically brought to a standstill. Thus the internal and external trade underwent something like a partial paralysis, so long as the *Emden* was able to rove the Indian Seas. The destruction of the *Emden* brought about a partial restoration—it certainly revived the confidence of the people, and influenced the return of the absentees to Calcutta. Things improved. But, of course, the position of trade did not revive all at once. It had been truthfully said that trade was a very shy bird, and, when once frightened off her nest, she took a long time getting back again. This was, sketched generally, but given a little more amply than the Directors set out in the report, the position of how things stood during the year. Its effect upon the Company was reflected in the accounts to which he would now turn.

THE YEAR'S TRADING AND FINANCES.

If the proprietors would look at the revenue account, the first item on the credit side was that of gas-rental which, as the Directors said, showed a diminution of 7¾ per cent. He did not think that he need elaborate this, because, as a matter of course, the gas-rental suffered. He would only say that, having regard to the misfortunes of numerous other gas companies throughout the world, they might congratulate themselves that, in their own case, it was no worse. With regard to the residual products, which also showed a considerable reduction, he would say a word or two. First of all, concerning coke. One effect of the war was to produce an absolute stagnation in the building trade; and a large quantity of slack coal and dust, which in normal times was used for brick-burning, lost its usual market, and was made into coke, and dumped on the coke market, to fetch just what it would. Then, again, coal, which, in ordinary circumstances, would have been exported, or shipped as bunker coal, was held up owing to considerable stoppage of outward sailings. He had also been given to understand that some collieries converted the whole of their output into coke. With their market flooded in this way, a diminished income from this residual was a foregone conclusion. They lost something like £4000 upon it, compared with the figures of the previous year. While on the subject of coke, he ought not to omit to tell the proprietors that, according to the latest advices, the coke market had had a very encouraging recovery. The price had gone up, but not too extravagantly at a time. He did not think it was a sudden boom to be followed by a corresponding slump. He believed this was a recovery of health and strength in the coke market; and he hoped it would last. The next item of residuals was tar. There again, they had a diminished revenue; but it was nothing at all comparable to the loss on coke. Finally, he came to a brighter spot—that was, sulphate of ammonia. He was happy to say their manufacture of sulphate of ammonia was progressing very nicely, though it had not yet attained the proportions to which the Board aspired. Notwithstanding, the profits last year showed an appreciable increase upon those of the previous year. Coming to the debtor side, the first item was coals, purification, and wages. Here they had a considerable saving—£2000 clear. Part of this was attributable to their having carbonized a smaller quantity of coal; and it was also due—he said this with great satisfaction—to better working in the matter of carbonization. He might remind the proprietors that this time last year, he told them how they had improved in their gas production per ton of coal carbonized. Then he was able to report an increase of 400 cubic feet per ton above the figures for 1913. Now they had improved upon this increased output by no less than 600 cubic feet. This was highly creditable to their General Manager (Mr. Snelgrove) and the carbonizing department generally. He thought he might also in fairness say that it bore some tribute to the quality of the coal they had been receiving from their contractors; and in this connection, the proprietors would be glad to hear that the Board had recently made on satisfactory terms an extended agreement with their coal contractors for supplies of coal for a very considerable time ahead. The supply of coal had given such trouble and such anxiety to numerous gas companies, not only in this country but all over the world, that he thought it was very gratifying that they had made this arrangement with their contractors, who were people of the highest substantiality; and therefore he believed the proprietors might rest assured that they would have no trouble with coal. Salaries in India and London showed the usual small progress. The item of Directors' and Auditors' fees remained the same. Indian income-tax was practically the same. Last year he stated that, shortly prior to the war, the Government had practically agreed to make some concession to those who had to pay what he might call a double income-tax—that was to say, on profits earned in one country and sent over to another. In their own case, the profits were earned in India and were sent over here. Unfortunately, the outbreak of war put a stop to the proposal. But the matter had not been allowed to sleep. Some gentlemen who were interested largely in Indian and Colonial concerns had got the question in hand, and at some future time were going to bring it before the Government again. The next two items—"mains, meters, services, and fittings," and "wear and tear of works"—showed some considerable saving. This, as the Directors assured the proprietors in the report, was not due to any neglect on their part with regard to the upkeep of the plant and buildings; they were kept up to tip-top pitch. The reduction was simply due to this: They had not had occasion to make any large capital outlay, or to enter upon any extensions or operations comparable at all with what they did the year before. The year before, they forecast what they might have to do. All that was thought necessary was then done; and this had happily avoided the necessity of any large expenditure this year. Consequently these items were reduced. Bad debts and allowances showed a gratifying decrease. Under general expenses, there had been a considerable saving. Last year he promised this should be so. Then they were burdened with an outlay of nearly £1500 for law expenses; and he said this would not recur. It had not done so; and they had made other savings under general expenses, so that the figure this year showed a reduction of more than £2000 as compared with the preceding one. The result of the whole trading was that the profits this year were £24,311, which was more by £75 than was earned last year. In addition, he would point out that all outlay had been carried to the debit of revenue; and the reserve fund was left intact at a figure of £6000—all fully invested.

THE BALANCE-SHEET.

He had not yet touched the balance-sheet. The capital stock, the reserve fund, and the depreciation account all remained the same. As to exchange equalization account, they had suffered to the extent of £200 on exchange in consequence of war conditions. With regard to this, he might mention one matter which had interested him, and it might the proprietors. The Government Controller of Indian Currency, in his last report, had pointed out that there was a contraction in the currency in circulation for the first time for several years; and in this way gold had been absorbed to an extent equivalent to nearly 75 million rupees. Probably this was owing in some measure to the extended general resort to paper currency. However this might be, it was a wholesome sign; and apparently the paper currency had become more and more popular. The 75 millions in gold went into the Government reserve and guaranteed the stability to a certain extent of the rupee at 16d. This reacted on the exchange. The proprietors might perhaps think that this was quite a minor matter. But these minor matters contributed either to advance or to hinder success; and the Board did not omit to keep their eyes on trifles. The amount due by the Company was a little more. This, however, was always a variable item; and it had no particular significance. If an account was paid on June 30, it was not then an amount due by the Company. If it was paid on July 1, it was. The Bank loan showed an increase of £2400. He would refer to this presently, when he came (as he now did) to the credit side of the balance-sheet. The capital expenditure remained the same. The amount due to the Company was less than last year by about £2800. It was now down below £10,000. This was a matter of great gratification to the Board. It sprang largely from their policy in having initiated, now more than a year ago, the giving to the consumers of a discount for prompt payment. This had been most beneficent. He might tell the proprietors that the eminent firm of English accountants who acted as their local auditors had dwelt more than once upon the excellent effects this concession to the consumers had had upon the accounts. It affected the arrears, and the arrears affected the bad debts. The bad debts arose from arrears; and the longer arrears were outstanding, the more likely were bad debts to be incurred. The next item was coals, products, and sundry stores, which showed an increase of £2000. In two words, this meant plainly that they had more stores in hand. Owing to the conditions of the war, they were much troubled in getting goods to India. In one or two instances, consignments they had in foreign bottoms were carried into Prize Courts, and were hung-up indefinitely. They had got them since. But in many other respects, it was difficult to get goods; and the Directors saw it was incumbent upon them to make the Company safe, for nobody knew what would happen during the war. They could not possibly allow themselves to be found short. Therefore, they bought stores to the full extent; and they had now the materials in their possession. They were worth more to-day than they paid for them; and he daresay that now they could not get some of them at all. Therefore he congratulated the proprietors upon having this £2000 more in store. The amount invested remained unaffected because they had not realized any part of it. Cash in Calcutta and London and bills receivable made together £5991. The mails were much delayed last year, more especially at the period when they struck their accounts. Bills receivable from India were consequently delayed. Had a bill which amounted to £4500 arrived on or before June 30, it would have been cashed, and carried to the credit of the loan from the bank. Then, instead of the bank loan being £2400 more, it would have been £2100 less, than last year. This showed that the loan account was in a much better position. What he had said he thought covered everything necessary with regard to the accounts. He could only say that if it had given the proprietors as much satisfaction to receive these accounts as it had afforded the Directors to present them, then they were quite content.

IN THE WORKS AND ON THE DISTRICT.

He thought perhaps the proprietors would like to know a little of what had been done in the way of works' operations generally. Some 381 new public lamps had been put up during the year, all of which meant good business. A considerable number of these were erected in Cossipore-Chitpore, with the Municipality of which, as he told the proprietors last year, the Company had entered into a twenty years' contract. A fair proportion of private consumers had also been obtained. This was a gratifying increase, especially as they could set it to a certain extent against the reduction of consumption which had been going on during the war. They were getting more consumers, though they did not consume so much as was being done before the war. But the consumers were now using gas not only for illumination, but for stoves, cookers, ring-burners, geysers, and for various trade purposes. Much of this was daylight consumption; and this was always valuable—indeed, it saved storage. In respect of mains, nothing particular had been done; they had only put in about 4 miles by way of extension. With regard to sulphate of ammonia, they were installing an enlarged plant; and when this was completed, he had no doubt they would be able to get a considerable improvement, even upon the improved figures to which he had already called attention. Some great improvements had also been made in their purifying facilities, with excellent results. The purifying ground had been extended and the plant enlarged; and, to their advantage, there had been erected within the works themselves new mechanics, blacksmiths, and moulders shops. This meant that they were now able to effect for themselves—at low cost, and under the Manager's eye—work which had hitherto been done for them outside. The advantage of this would be at once patent. In regard to the distribution department, he told the proprietors a year ago that it was being removed from the district office into the works. This change had also been effected, and was also entirely satisfactory. It had produced increased efficiency, the working expenses were reduced, and again everything was under the Manager's eye. In the meter department, they had made several changes, which had been attended with similar happy results. In respect to the purity, pressure, and illuminating power of the gas, they were under very strict regulations and obligations to the Municipality, who had most elaborate testing apparatus; and, in the course of the year, many thousands of tests were taken. Now even in the best regulated gas company, it was not always possible for the manager to avoid some accidental little slip or other, which might produce a deficiency in one or other of the three particulars—purity, pressure, or illuminating power. He was happy to tell the proprietors that throughout the whole year they had not had a single complaint from the Municipality with regard to a deficiency. He thought this was very creditable to their Manager and staff; and he had much pleasure in proclaiming it.

INDIA'S CONTRIBUTION TO OUR FIGHTING FORCES.

The Directors had sent another subscription to the Indian Soldiers' Fund in the name of the Company, which he was sure would meet with the warm approval of the proprietors. The claims of this fund upon the people of England were stronger than ever, for the numbers of the Indian troops fighting with and for this country had largely increased during the year. He quoted the following from a telegram sent from India this month: "India continues to furnish important contributions towards the equipment of the British and Allied Forces. Recruiting for the Indian Army proceeds vigorously, especially among the Sikhs, Gurkhas, and Punjab Mohammedans, and the entire country shows the keenest resolve to give all possible aid to secure the final victory of the Empire." The more warlike of the Indian races were among the finest fighting men in the world. Mr. Asquith, speaking in the House of Commons this month upon the contingents furnished from various parts of the Empire, used these words: "The contribution of India is splendid." He (the Chairman) thought it was of good augury for the future welfare and happiness of India that so many of her sons, of all ranks and all classes, had seen England for themselves. A year or two ago it might almost have been said that the two races, English and Indian, knew next to nothing of each other. Ignorance was prone to beget prejudice, and even a tendency to dislike, because each misunderstood the other. But now, English and Indian, fighting together for a common cause, glorying together and suffering together, each had learnt to appreciate the great qualities of the other; and the future would witness an attachment and a mutual respect, hitherto unattainable, but now full of promise.

MUNITIONS FROM INDIA.

There was one other matter he would touch upon. As the proprietors were probably aware, in England more than 1000 private undertakings were now in the public service as controlled establishments engaged in turning out munitions of war. Many of these were drawing from the local gas companies large supplies of gas for light, heat, and power purposes; and beyond affording supplies to these factories, the gas companies were themselves making shells and fuses, while from their gas and tar was being extracted the most powerful explosive known to science. India had not been slow to follow this example. He quoted again from the message from India: "It has now been proved beyond question that India is capable of making shells outside her ordnance factories, thanks to the cordial co-operation of the railways, private firms, and the native chiefs who have placed their workshops at the disposal of the Government. There has been no difficulty to carry out there all the processes from iron up to the finished shell. The quality of the work is understood to have been excellent." The Company had not yet been approached by the Government of India. But if and when they were, they would be prepared not only to supply gas to munitions factories for power and lighting purposes, but also to do whatever else the Government might think it within the Company's power to do by way of promoting the production of war material.

THE FUTURE.

With regard to the future, he would rather not say anything. He could not hazard any forecast at all. That was beyond the wit of man. All he could say was that the Directors would continue to give their most careful attention to the interests and the affairs of the Company, and do their utmost to promote them. The poet had said: "'Tis not in mortals to command success." This was true; but the Directors would do their best to win it.

Mr. Robert Miller seconded the motion, which was unanimously carried.

The Dividend—Re-Elections—Votes of Thanks.

Proposed by the Chairman, and seconded by Mr. A. T. Eastman, a dividend of 8 per cent. was declared, less income-tax and the interim payment of 3½ per cent.

Moved by the Chairman, and seconded by Mr. William Williams, the retiring Director (Mr. Eastman) was unanimously re-elected.

On the proposition of Mr. John Mitchell, seconded by Mr. W. C. Ellison, the Auditors were reappointed.

The Chairman, in moving a vote of thanks to the Manager, Secretary, and staff generally, said he had already had to draw particular attention to several points upon which they were much indebted to their Manager for his good work. He thought the management had been extremely well conducted. Mr. Snelgrove had had to contend with a very sickly season. He had had from time to time several of his assistants laid up through illness; and thus had thrown upon his own shoulders a great deal of extra work. Mr. Snelgrove had borne it without the slightest word of complaint; and he (the Chairman) thought their Manager especially deserved their thanks, when they considered the distressing circumstances caused by the war and the harassing uncertainties—not knowing when or whether he could get supplies, and not knowing what was going to happen next to him and his subordinates. He also proposed that they should give a hearty vote of thanks to their good friend the Secretary, who had been with them twenty-three years next month. He was a most painstaking and efficient Secretary, and always ready to give all reasonable information to the proprietors who desired it.

Mr. Stanley H. Jones seconded the motion, which was carried.

The Secretary responded on behalf of his colleagues and himself.

A vote of thanks to the Chairman and Directors was also proposed and duly acknowledged.

OTTOMAN GAS COMPANY, LIMITED.

A Formal Meeting.

The Half-Yearly Ordinary General Meeting of the Company was held last Tuesday, at the London Offices, Nos. 59 and 60, Gracechurch Street, E.C.—Colonel JAMES LEGEYT DANIELL (the Chairman) presiding. The proceedings being of a purely formal character, there was but a small attendance of shareholders.

The SECRETARY (Mr. C. J. Daun) read the notice convening the meeting, in which it was stated: "The Directors regret that, owing to he continuance of the war, they can neither present the usual report and accounts, nor recommend any dividend."

The CHAIRMAN remarked that this was the shortest report the Board had ever had to make. There was a meeting in May last, when he explained the circumstances; and the only reason for calling a meeting now was to conform to the Articles of Association, under which the shareholders were entitled to a half-yearly meeting. In times of peace, also, they had been entitled to half-yearly accounts; but as the Company's property was on the other side of the world, and the Directors were here, they did not know anything about the real state of affairs at the present moment. They had practically no information on the subject. A report appeared in a newspaper at one time as to the Company's works having suffered from bombardment; but they had learnt since that this had not happened. Beyond that, he was not n a position to say anything. This state of affairs was, of course, most unsatisfactory to the Board; but at the same time they must take comfort from the fact that things had not been worse. All that remained for him to do was to thank the few shareholders present for their attendance.

Mr. F. W. BROTHERS inquired whether they were receiving remittances from the other side. He was under the impression that the works were in the hands of the English staff.

The CHAIRMAN replied that they could not deal with the enemy; and if there were any money the other side, it would not be allowed to leave the country. He added that at the previous meeting he had made it clear that soon after war was declared the Government gave the Company notice that the works were under Turkish authority; and they arranged for people to look at the accounts, and see how the gas was made, and everything else. They only paid one or two visits, however—possibly because they found the business was rather too complicated for them. As soon as the Board were in possession of any reliable information, they would be only too glad to impart it to the shareholders.

Mr. E. L. BURTON said this seemed to him a meeting for mutual commiseration; but the shareholders having heard all there was to be said—and this was *nil*—would no doubt wish in the usual way to thank the Chairman and Directors for looking after such of the Company's interests as there were to look after during the past half year. No one connected with foreign undertakings could escape anxiety at the present time; and a full measure of this anxiety must have fallen to the lot of their Board. Their thanks were therefore due to them; and he proposed that they be given.

Mr. BROTHERS seconded, and remarked that he supposed gas was still being made.

The CHAIRMAN: If so, I do not know where they are getting the coal from. The Board are exceedingly obliged for the vote of thanks. The business has been a source of the greatest anxiety to us; but we must hope for the best.

BIRMINGHAM GAS SUPPLY.

Another Appeal to the Consumers to Economize.

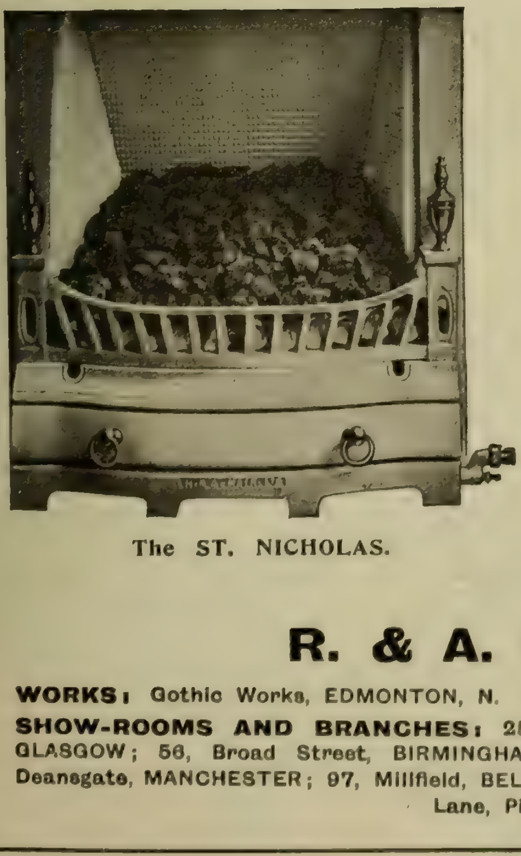
Following up the intimation contained in their last month's report [see *ante*, p. 213], the Gas Committee of the Birmingham City Council, at a meeting yesterday week, presided over by Alderman Sir Hallewell Rogers, decided to make an appeal to gas consumers in the area of supply to be as economical as possible in their demands on the department, in the interest of munition and other manufacturers.

According to the "Birmingham Daily Post," the supply of gas for munition works has increased so rapidly during the last few months that the resources of the department have been taxed to their fullest extent. For some weeks the output has been 30 million cubic feet higher every week than in the corresponding period of last year; and at the present time the daily supply is almost equal to the maximum which is generally reached from the end of December to the middle of January. And it is found that the demand for further supplies for munition works is continuing. The consumption, in fact, is already so unprecedented that, owing to the shortage of labour at the gas-works, the department will, unless the ordinary consumers help them, be faced with a serious difficulty. As the munition works are of national importance and must be maintained, the Committee naturally will do everything to keep them well supplied with gas, even if they are compelled to curtail the domestic supplies—a method which has been adopted in several munition centres. The Birmingham Committee will not take such a drastic step unless it is absolutely necessary; and they therefore appeal to domestic consumers to exercise the strictest economy (particularly during the next two months), in the use of gas for cooking purposes, and especially in the use of gas-fires.

The following appeal on the subject is prominently advertised throughout the district:

The supply of gas for munitions has, during the past few months, been increasing very rapidly, and further demands for large supplies

THE MAIN GAS FIRES.



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The Gas Fire without a rival.

The new booklet—"Main Reflections"—contains particulars of several new Gas Fires. Copies free on application.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

for this purpose continue to be made. The consumption of gas is so unprecedented that the resources of the Gas Department are already severely taxed—the difficulties being increased by the shortage of labour at the gas-works.

The Gas Committee feel that the munitions supplies are of national importance and must be maintained even though this may mean the curtailment of domestic supplies (a course which has been already adopted in several munition centres).

The Gas Committee therefore desire to again impress upon consumers the necessity for exercising the strictest economy in the use of gas, particularly during the next two months (when the consumption usually reaches its highest point). They confidently ask consumers to show their patriotism by co-operating in this matter, and thus avoid the necessity for more drastic steps having to be taken.

HALLEWELL ROGERS,
Chairman of the Gas Committee.

Nov. 23, 1915.

BRISTOL AND GAS TESTING.

Sanitary Committee's Views on a National Emergency.

The question of testing the gas supplied by the Bristol Gas Company, at the present exceptional time, was considered at a meeting of the Sanitary Committee last week, when it was decided, after consideration of the communications from the Ministry of Munitions on the subject, that it should be continued.

It was reported by the City Engineer (Mr. L. S. M'Kenzie) that the Minister of Munitions had forwarded a copy of a letter which he had addressed to the Bristol Gas Company, pointing out the necessity of extracting as much benzol and toluol as possible in the making of gas for the purpose of the manufacture of explosives; and as the illuminating and calorific power of the gas might be thereby affected, the Company were informed that they would be relieved of any penal consequences of not keeping their gas up to the standard imposed by law. The Corporation were asked to do everything in their power to prevent any possible attacks on the Company in consequence of this order; and it was suggested that for the time being the gas need not be tested, or, at any rate, the results of testing should not be published.

The CHAIRMAN (Alderman S. Lloyd) said in his opinion it was their duty to go on testing the gas. The whole community would be affected; and the Committee would not be doing their duty unless they continued to test the gas. By so doing, they would know exactly how they were going on.

Mr. BILLING thought the subject should be considered by the Works Sub-Committee. As the quality of the gas would be affected, they ought to get a reduction in price. Gas was used for heating and cooking, as well as for illuminating purposes; and it was obvious that if certain things were taken out of it which reduced its effectiveness, consumers should receive some compensation.

Mr. CURTIS urged that the question should be settled at once. The Government were making certain demands upon the Company, and the Committee were asked to give every facility so that they might be complied with. Immediate action was necessary; and yet it was proposed to defer consideration of the matter. They were approaching a national matter in a parochial spirit; and he objected.

The CHAIRMAN proposed (and it was agreed) that the testing of the gas should be continued, and that the consideration of the other points involved should be referred to the Works Sub-Committee.

Mr. BILLING said he thought they should go a step further; and he gave notice of his intention to propose: "This Committee are anxious to adopt the suggestion of the Government as to altering the quality and present mode of gas supply, and would ask the Gas Company to supply the Committee with information as to the effect of the alteration in cost, heating, and lighting standards, for consideration at the next meeting of the Works Sub-Committee."

THE CURTAILED GAS SUPPLY AT KEIGHLEY.

A Report by the Gas Manager.

Reference was made in the course of the proceedings at a meeting of the Keighley Town Council to last week's announcement [*ante*, p. 452] that on three days a week—Saturday, Sunday, and Monday—the gas supply would be cut off from 8 a.m. to 4 p.m. The Chairman of the Gas Committee was asked whether he could give any more information on the subject; Alderman Midgley remarking that they had been without electricity, they had been very nearly without water, and now they were going to be without gas. The Council were entitled to some explanation as to who was responsible for this blundering in the gas business. Alderman Smith said that if Alderman Midgley could remember who were the members who voted for postponing the letting of the tenders for the new retorts, he would be able to say who was responsible for the blundering. If Alderman Midgley was one who voted for that, he was more to blame for the present state of things than the Gas Committee. The Gas Manager (Mr. W. Baillie) had assured them that if the letting of the contracts was delayed, they would be without gas. Mr. Mullen pointed out that there were two sides to the matter. The Manager had also told them they might go on for two or three years longer with the old retorts. Mr. Wardle said he was proud he opposed the expenditure, because he was satisfied the work could have waited. Mr. Harrison (the Chairman of the Committee) said that at the last meeting of the Committee the Manager had thought they would be able to have the new retorts working in three weeks. He hoped they would be able to get along in the meantime without any further curtailment than had been so far announced; but it would depend very much on the weather. With respect to the

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marks of Mr. Wardle, if he had seen the retorts that had been
illed down, he would not have said they could have lasted another
/o or three years. Mr. Murgatroyd added that the Manager hoped
three weeks' time to have a supply of gas for the whole district.

Mr. Baillie has made a report to the Gas Committee in regard to
e circumstances which have necessitated this shutting-off of the gas
pply at week-ends. Referring to the re-construction of a portion
the carbonizing plant, he says:

For some time it has been evident that the contract would not be
mpleted in the specified time. The work was let to the contractors
January; and among the conditions was one giving a guarantee for
e completion of the whole of the work by the first day of October.
wing, however, to the shortage of labour and the difficulty of obtain-
g materials, they have been unable to complete the work in the time.
nother condition laid down and accepted by the contractors was that
e stack of five settings, chimney, and steel structural work should be
mplete in all respects and ready for work by Sept. 1. Failure to
mply with this condition involved them in a heavier penalty, as these
ttings were absolutely essential for maintaining a full and continuous
pply of gas from October to March. It is the non-fulfilment of this
ndition that has caused the interruption in the supply of gas at the
esent time. It is also unfortunate that the Committee's recommen-
tion for the reconstruction of the plant was deferred for further con-
deration, as, during the interval, a contract of similar magnitude was
ven to the contractors by another corporation, which received pre-
rence in construction, and has since been completed.

The contractors have, on several occasions, been urged to speed-up
e work of construction, but have complained of an inadequacy of
bour, a drainage on their regular staff of skilled workmen for muni-
on works and enlistment; and the work being held up through the
n-delivery of gearing, motors, silica, and fire-brick material. To
pedite matters and assist the contractors, the Committee gave me
structions to write to the Minister of Munitions, pointing out the
rious consequences that would ensue if the contract was not com-
eted in the specified time. The department, taking the matter in
nd, gave instructions that no more skilled men were to be drafted
om the contractors' works for munition work until the Keighley con-
act was completed, and also gave every assistance in urging forward
e delivery of motors, &c., in order that the work should not be at a
andstill. Unfortunately, although the contractors received material
lp from this intervention, the work has been delayed through a strike
their labourers, and other causes.

Our own difficulties in maintaining a full supply of gas to consumers
e due to the existing plant being unable to cope with the very large
mand for gas. At the present time, with sixty-five retorts, we are
aking 1,300,000 cubic feet per diem; but, owing to fog and wintry
nditions, the demand, on reduced pressure, has on several days ex-
eded the make by more than 400,000 cubic feet, and will continue to
crease. This drain on our reserve storage has practically emptied
e gasholders; and, in order to ensure a satisfactory working pressure on the mains, and maintain a regular quality of gas, it became necessary to have the gasholders refilled. The only available method of doing this was to curtail the supply of gas to the town. Before acting in this direction, however, I caused inquiries to be made as to the most suitable days on which this might be accomplished, and more particularly among users of gas for power purposes. The majority of users so canvassed accepted Saturdays and Mondays as the days which would cause the least inconvenience and loss of working time. I accordingly, after consultation with the Chairman, gave instructions for the issue of notices warning the general public as to the intended curtailment of the supply.

The following letter from the contractors had been recently received by Mr. Baillie: "Although we have strained every nerve to complete the vital portion of the plant in time for your requirements, we have been unable to do so through shortage of necessary materials and suitable skilled men. We have for a considerable time now been working night and day, Sundays included, with such fitters as were available for the work; and we hope by the end of this week to have the charging machine ready for despatch. Within three weeks of despatch we hope to have the erection completed and the machine charging your retorts. The difficult situation in which we are placed is entirely due to our inability to obtain essential materials when required and fitters skilled in this class of work, owing to the demand for such men in the great armament works, and a large number of our regular men having enlisted. . . . We trust the strenuous efforts we are making will soon release you from a very difficult situation."

AMSTERDAM CORPORATION GAS UNDERTAKING.

Report for the Year 1914.

The report on the working of the gas undertaking of the Amsterdam Corporation for the year 1914 states that in the first half of the year there was normal development in the operations, resulting in an increased production of gas of 7·5 per cent. in comparison with the corresponding half of the year 1913. With the second half of the year, however, a great change occurred. The supply of coal fell off to such an extent that in August only 4 per cent. of the contracted quantity of German coal was delivered; and for the whole of the last five months of the year the deliveries amounted to only 56·7 per cent. of the quantity contracted for. In order to compensate for these short deliveries, 53,800 tons of English coal were purchased—with difficulty and at much higher prices than at normal times. A larger proportion of water gas was also made at the West and East works, in order to economize coal as far as possible. The second half of the year showed a reduction in the gas disposed of—1⅓ per cent., as compared with the second half of 1913.

The working for the whole year showed an increase of 2·85 per cent.

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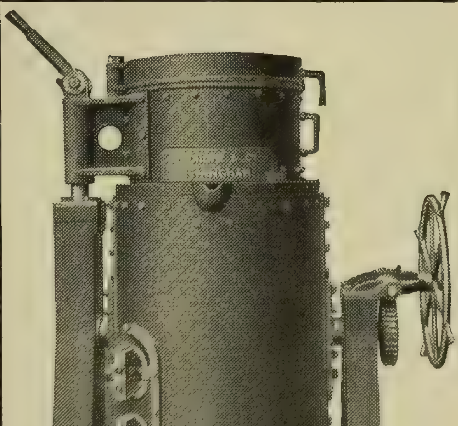

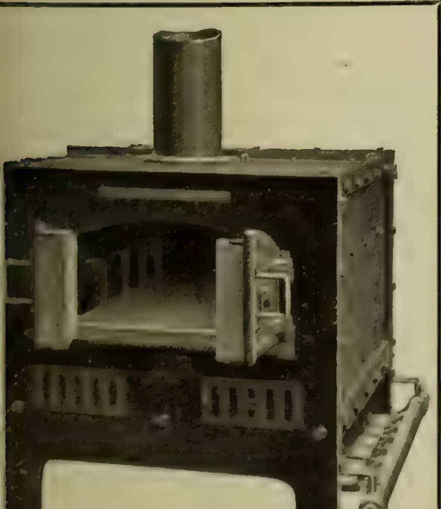

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ESSEX WORKS, ASTON, BIRMINGHAM.

in the gas distributed. A number of repairs and extensions of plant at the four works of the Corporation were carried out in the course of the year. The total quantity of coal carbonized was 258,317 metric tons, of which 87·28 per cent. was Westphalian, 12·64 per cent. English, and 0·08 per cent. Dutch gas coal. The East works consumed the largest quantity—viz., 94,070 metric tons, the South works consumed 91,895 metric tons, and the West works 71,312 metric tons; the remainder being consumed at the small North works. In addition, 5286 metric tons of oil were used in the manufacture of carburetted water gas. The make of gas per ton of coal carbonized was, at the West works 10,717 cubic feet, at the East works 10,463 cubic feet, and at the South works (which have vertical retorts with steaming) 13,440 cubic feet. The water gas produced at the West and East works amounted to 29·58 per cent. of the total production of gas at these two works. The total production of gas during the year at all four works amounted to 103,940,230 cubic metres (about 3670 million cubic feet), of which 19·70 per cent. was carburetted water gas. The maximum consumption of gas in one day was on Jan. 6, when it amounted to 399,505 cubic metres, or 0 384 per cent. of the year's supply.

The production of coal tar amounted to 4·484 per cent. by weight of the coal carbonized. The water gas plant produced 1159 metric tons of tar. The production of ammonium sulphate was equivalent to 0·942 per cent. by weight of the coal carbonized. Spent oxide sold amounted to 1231 metric tons. The total length of mains in the distributing system, from 4 to 47 inches in diameter, at the end of the year was 281 miles, there having been an increase of about 7 miles in the course of the year. The total number of ordinary meters in use at the end of the year was 52,301, and of prepayment meters 75,917. There were 10,344 public gas-lamps in use at the end of the year, of which 8861 were provided with No. 2 Kern burners. Of the total consumption of gas registered by meters, 44·35 per cent. was consumed through prepayment meters. The mantle factory at the East works produced 31,892 mantles out of a total of 362,735 mantles received for use by the department.

The report mentions changes in the staff consequent on the death of Heer M. J. Müller, the Engineer of the West works, on June 18, 1914. Heer M. van der Horst, the Engineer of the East works, was transferred to the West works on Aug. 1, and Heer A. Kempkers, an Assistant Engineer, was appointed to succeed him as Engineer of the East works.

Out of the profits of the year's working of the undertaking, 2,235,999 fl. (£186,333) was handed over to the municipal chest.

* * *

Deaths from Gas Poisoning.—Margaret Matthews, 86 years old, was found dead in bed at Abercynon, with the room full of gas. The burner was unlit; and it is thought that deceased, in putting the light out, must have accidentally turned the gas on again. A naval pensioner (aged 74) committed suicide at Hackney, by placing a gas-tube in his mouth, and wrapping the bedclothes round his head. He was stated to have had all sorts of imaginary grievances.

COAL TAR AND ITS PRODUCTS.

Continuing (and possibly concluding) the correspondence, in the "Iron and Coal Trades Review," which has in part been reproduced in the pages of the "JOURNAL," our contemporary's correspondent "Distillation" wrote last week that he had neither the time nor the inclination to continue the discussion, but thought the last letter of Messrs. Hird, Chambers, and Hammond called for a reply. He wrote:

So far from their "little explanation" reducing the number of the writer's objections to the statements in their original article, their letters have only confirmed them. They still indulge in misleading and exaggerated statements and estimates, with no reliable evidence to back-up their figures. They have evaded direct answers to straight questions, and have failed to indicate where they have erected plants and are producing the quantities of oils, benzols, and carbolic, and making the fabulous (and, to the writer, impossible) profits, as stated in their article and letters.

In their last letter they state that oils can be sold at 5d. per gallon, and show the following results: 80 gallons of oil at 5d. per gallon, £1 13s. 4d.; 12 cwt. of pitch at 15s. per ton, 9s.—total, £2 2s. 4d.; less working expenses, 5s. 4d.; net value of products, £1 17s.

On referring to a previous issue, it is found that creosote oil is selling at 3¼d. per gallon, and from the writer's actual knowledge the latter is the correct figure, and not 5d. as stated by Messrs. Hird, Chambers, and Hammond. Then the net value of the products is really the gross value, as there are many items of cost (that the writer could enumerate) which they ignore. Evidently, commercial experience and accountancy do not form part of their stock-in-trade.

The writer did not set out to demonstrate that: "(1) Tar should not be distilled at the point of production," or "(2) it is at the present time an unprofitable undertaking." What he does state is that it is just as impossible to-day to get 25s. for a £1 Treasury note as it is for Messrs. Hird, Chambers, and Hammond to make the profits by distillation stated in their original article.

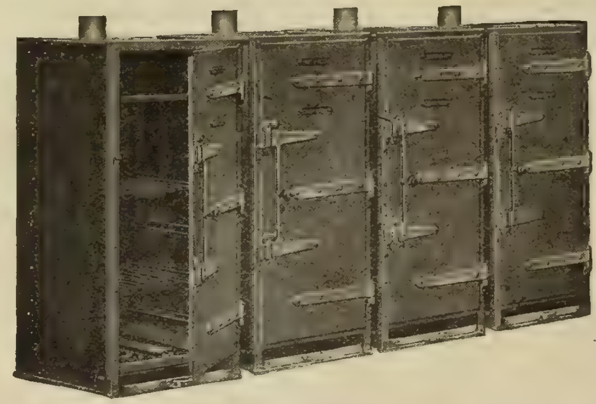
It would appear to the writer that they place too high a valuation on coal tar and its products, and too low a one on the intelligence and business acumen of their circle of readers.

There is also another serious aspect to the circulation of the estimates of Messrs. Hird, Chambers, and Hammond; and that is the effect produced on the minds of the employees. No wonder there are wages troubles when the latter see such statements (as these are copied, however misleading they may be), and so get the impression that huge fortunes are being made by their employers out of small plants!

* * *

The Power Gas Corporation are to pay a dividend on the ordinary shares for the year ended Sept. 30 last at the rate of 6 per cent. per annum, less income-tax.

Mess Rooms, Canteens,
Works Kitchens, etc.



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The Parliamentary War Savings Committee urge the use of gas; the military authorities and patriotic employers, if approached by you, will be glad to respond. Richmond's can provide all necessary apparatus.

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COUNTY COUNCILS AS WATER AUTHORITIES.

Presidential Address of Mr. H. C. Adams to the Institution of Municipal Engineers.

In the course of his Presidential Address to the Institution of Muni-
pal Engineers last Saturday, Mr. Henry C. Adams dealt at some
ngth with various matters concerning water supply. Speaking of the
portance of a piped water supply, he pointed out that thirty years
o, out of the 944 urban sanitary districts then existing, no less than
1, or more than 25 per cent., had no piped supply at all, and in
any of those which had this conveniece, only small parts of the dis-
cts were supplied. Now, out of 1130 boroughs and other urban
stricts, there were only 67 in which fewer than half the residents
d a piped supply; while 29 were without a piped supply at all. The
ter, however, were generally very small places.

In the rural districts, piped supplies were gradually becoming more
merous. There were, however, still about 8000 parishes, with a
al population of several millions, which had no proper supply;
ile in many other cases only parts of the parishes had piped sup-
es. The result was that the difficulty of getting the water to the
uses brought about a much lower standard of cleanliness. It was
nerally conceded that 8 gallons per head per day was essential to
cure anything approaching reasonable cleanliness; but in a case he
cently investigated the amount was as low as 2½ to 3 gallons per head
r day, and the result was very obvious in the condition of the pro-
rty and the utensils. It was as a matter of fact physically impos-
le for the tenants to fetch more water than they did.

Most of these instances were found in localities situated several
les from the source of supply when anything more than a supply
m shallow wells was too expensive to be contemplated. Rural dis-
cts, or even parts thereof, could combine for the purposes of water
pply under section 279 of the Public Health Act, 1875; but local
lousies often prevented many a good scheme being carried into
ect. It might frequently happen that while co-operation would
imately be advantageous to two parishes, at the moment one party
ly would reap the benefit while the other would be temporarily at a
advantage—as, for instance, where one parish badly in need of water
s to go to obtain a supply into an adjoining parish which, although
piped, has a fairly adequate supply for present needs. Obviously
th parishes could be provided with a piped supply for practically
e same cost as the one; but the residents of the second parish would
sitate to incur expenditure upon a scheme which, at any rate, they
uld not need for some time to come.

Circumstances of this nature were responsible for the cost per head
rural water supply being frequently much higher than in towns,
d the people were usually less well able to bear it. The only
medy was to widen the incidence of the cost; and while something
this direction might follow the establishment of the proposed central authority, with satisfactory Rivers Boards [formed of Joint Committees of county councils, each having jurisdiction over the whole of a watershed and river basin], for the present some relief could undoubtedly be obtained if the county councils were made the water authority for the rural districts within their areas, and the cost of each individual scheme levied on the whole county instead of on the particular parish. There was no reason, except the financial one, why the water supply should be less in quantity or poorer in quality in the country than in the towns. With water supply schemes upon a broader basis, the time might come when a piped supply would be available to farmers equally with the inhabitants of the villages.

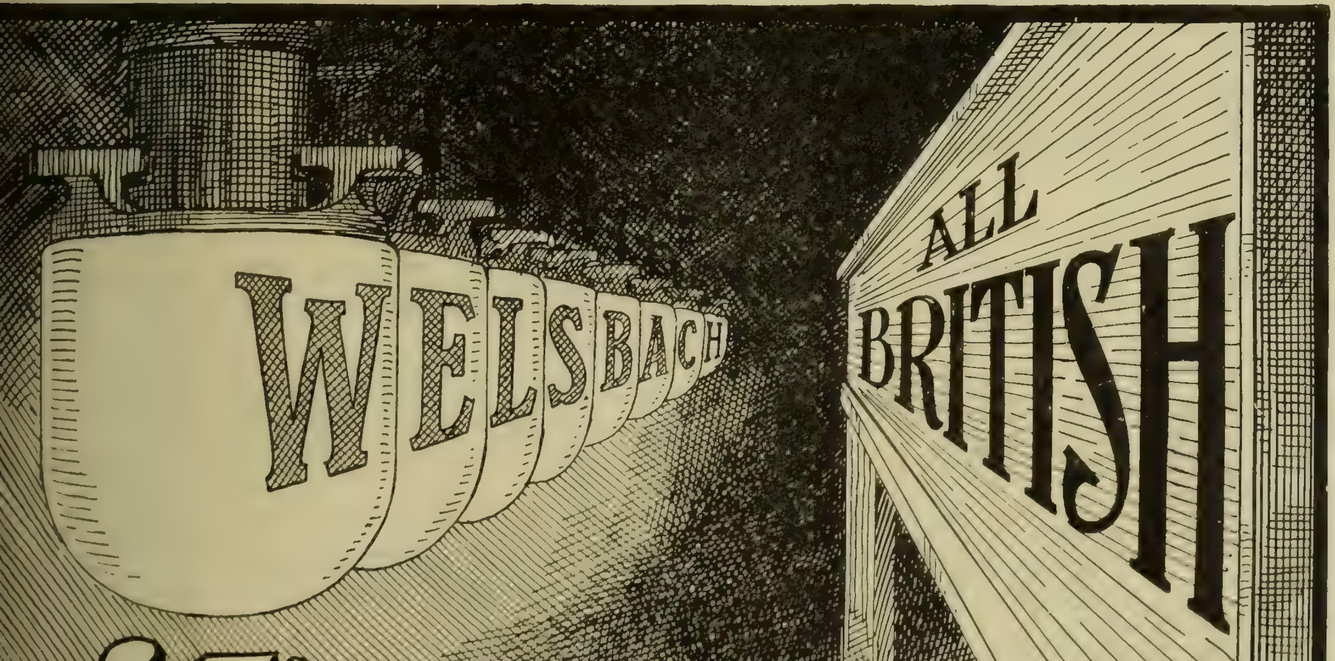
Dealing with the incrustation of water-mains, it was pointed out that newly-laid pipes usually had a surplus capacity, and it was possibly owing to this fact that they ran from 30 to 35 years before incrustation caused serious trouble. In considering the question of whether it was better to scrape or renew a main, the critical diameter was about 6 inches. Above this it would generally pay to scrape; but below this size there were many points to be considered before a decision could be come to. These smaller pipes were generally distribution mains rather than supply mains; they were in shorter lengths, and had projecting ferrules from the house services at intervals. The eventuality of having to scrape the pipes should be taken into consideration when designing new schemes, in order that the dislocation of the service should be reduced to a minimum. Among the provisions which should be made were hatch boxes in brick chambers at suitable places, a plentiful supply of sluice-valves, and arrangements for the easy disposal of the wash water without damage to the roads or adjoining lands; while a service reservoir near the town was of great assistance. It was generally found that when mains have been once scraped, the operation has to be repeated again at more or less frequent intervals. It was recently reported that in Stirling County, the mains have to be scraped every three months.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

It has been unanimously decided by the Dundee Gas Committee to recommend an advance of ½d. per hour in the wages of the labourers employed by the department. Mr. R. M. Noble (the Convener) explained that they were very short of men. Their rate of pay at present was 6½d. per hour; and it was felt that they would get sufficient men if they increased it to 7d. The gas-works labourer was not an ordinary labourer. He had to know some technical details appertaining to gas-works, and to be trained for the work. There was hardly a man in the gas-works now who was there two years ago. Mr. Robertson asked if any new element had developed since the last meeting, when the question of wages was deferred. Mr. Noble replied that the crisis had become more acute; and the men were wanting to go away so that they



Write for Particulars and Samples.

THE WELSBACH LIGHT COMPANY, LTD.,
WELSBACH HOUSE, KING'S CROSS, LONDON, W.C.
And at BIRMINGHAM, MANCHESTER, LEEDS, STOKE-on-TRENT, HULL, BRISTOL, and DUBLIN.

Welsbach Mantles are Upright (C, CX, and Plaissetty) and Inverted.

would secure higher wages. He understood the men would be satisfied with an increase of ½d. The Gas Manager (Mr. A. Yuill) stated there were 63 labourers at the works. Bailie Barnes remarked that his only difficulty was as to the effect which the proposal might have on the labourers in other public departments. Mr. Noble, however, pointed out that the men they were now dealing with were wrongly called labourers. They should be termed gas workers.

A demand by the gas-works employees for advances in wages has been considered at a special meeting of the Falkirk Town Council, when it was decided not to accede to the request. A Sub-Committee had recommended increases of 6d. per shift to the boilermen and enginemen, whose present wage is 4s. 6d. per shift; ½d. per hour to the gas-fitters, whose present hourly rates range from 7½d. to 8½d.; 3d. per shift to the machinemen, whose present wage is 5s. 3d. per shift; 3d. to leading stokers, who now receive 5s. 6d. per shift; and 3d. to cokemen, who are paid 5s. per shift. Treasurer Gilchrist, in moving approval of these proposals, said that some members might not be prepared to support the increases, as the men had threatened to strike. Mr. Miskimmin thought if the men struck work they might find themselves in difficulties, as they were wearing Government badges.

One fatality and severe personal injuries in several cases resulted at Kirkintilloch during this evening through the bursting of a cylinder containing a quantity of gas at high pressure, which was being taken on a motor-lorry to the acetylene works at Gallowhill. Portions of the cylinder struck and killed Alice Lynch, while Catherine Graham and Agnes Baxter were badly cut. The driver of the lorry was found suffering from shock; and another man was injured. Portions of the cylinder were found 200 yards away.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Nov.* 29.

The market for London tar products is featureless, except for the pitch position. It is possible that some merchants have sold pitch abroad at prices which, with present high freights, would mean a loss. Such a thing would be unfortunate; but it would hardly be fair to tar producers to pass such loss on to them by taking it out of the pitch price, as in the reverse case they would not have benefited by a merchant's advantageous sale. For new business, some Continental buyers are willing to meet the freight situation, and to propose improved prices.

Sulphate of ammonia continues to move steadily upwards. About £15 15s. net per ton, in buyers' bags at makers' works, for 25 per cent. quality, is obtainable for prompt delivery, and 5s. premium for January-June.

Pitch.

London, *Nov.* 27.

Although there have (Messrs. Blagden, Waugh, and Co. write) been possibilities of a moderate amount of business in pitch during the week, negotiations appear to have been mostly unsuccessful, owing to the extreme difficulty connected with freighting. Makers in London would still entertain figures last quoted—viz., 17s. to 18s.—and would like to see speeding-up of deliveries.

Tar Products in the Provinces.

Nov. 29.

The market for tar products remains very quiet. In pitch, some very reasonable prices are being accepted for prompt delivery. Creosote is quiet, and is very difficult to sell. Solvent and heavy naphthas continue in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 9d. to 22s. 9d. Pitch, East Coast, 16s. to 17s. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, London, 2s. 1d.; North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Nov.* 27.

There has been no diminution in the strength of the market for this article during the past week, and all parcels offered for sale have found ready buyers at steadily advancing prices. The demand from abroad has continued good, and manufacturers of mixed manures in Great Britain have bought fair quantities. The closing quotations are £16 5s. per ton f.o.b. Hull, £16 10s. f.o.b. Liverpool, and £16 12s. 6d. f.o.b. Leith. With the further advance in the values for this year, the premium for the first few months of next year has disappeared, and it is reported that several transactions have taken place, for delivery up to March and April, 1916, at prompt prices.

Nitrate of Soda.

There is no change in either the tone of the market or the value of this material, and quotations are repeated at 14s. 4½d. per cwt. for ordinary, and 15s. 7½d. for refined quality, on spot.

Careful attention will be given to YOUR enquiries.

R. & J. DEMPSTER, Ltd., MANCHESTER.

London Office:
165, Gresham House,
Old Broad St., E.C.

Sulphate of Ammonia.

From another source, it is stated that the market for this article has remained very firm throughout the past week. Outside London, makes are quoted at £15 ; Hull, £15 15s. ; Liverpool, £15 17s. 6d. ; Leith, £16 ; Middlesbrough, £15 17s. 6d.

Under date of Friday last, Mr. S. E. Halliwell, of Littleborough, the Hon. Secretary of the Lancashire Commercial Section of the Manchester District Institution of Gas Engineers, writes that the average prices realized for tar—based on the value of the products—in the Manchester district were as follows :—

July	28s.	10d.	per ton.
August	27	8	,,
September	27	2	,,
October	26	2	,,

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is fairly brisk when the scarcity of ready steamers is kept in view. Near the end of November, there is a general desire on the part of coal consumers to get stocks for the coming holidays as far as possible ; and the demand this time for export is rather fuller than last year. In the steam coal trade, the request is fair, more especially for best Northumbrians, which are quoted from 19s. 6d. to 19s. 9d. per ton f.o.b. Second-class steams are quiet at about 17s. per ton. Steam smalls are rather more plentiful, and are from 10s. 6d. to 12s. per ton, according to quality. Work at the collieries is good, when the depleted ranks of labour are remembered ; and the output is well taken up. In the gas coal trade, production is fair, and the demand is full. Deliveries on long contracts are naturally heavy at this season ; while exports are also heavy, especially to France. Best Durham gas coals are 19s. 6d. per ton f.o.b. ; second-class qualities are 16s. 9d. to 17s. per ton ; and "Wear Specials" from 20s. to 20s. 6d. per ton f.o.b. The gas coal trade for prompt delivery is not only impeded by occasional lack of tonnage, but the rates of freight are higher—about 14s. 6d. Tyne to London, and as high as 24s. 6d. to Rouen, being now quoted. Several large contracts for Durham coals for next year have been fixed at about 4s. per ton above the corresponding prices. Coke is firm, with an upward tendency in the price. This has its effect on gas coke, which for export is quoted at 26s. 6d. to 29s. per ton f.o.b. for good makes. Some inland gas companies have raised their prices for gas coke.

Fire at the Stafford Gas-Works.—A building used as a store and fitting department at the Stafford Corporation Gas-Works was burnt out on Monday morning of last week. Fortunately, however, the brigade were successful in preventing the fire spreading to buildings in close proximity, one of which was the governor-house.

Sedgley Gas Undertaking.

The annual accounts of the Sedgley gas undertaking were issued on Saturday, and show a total income of £10,652, including balances at the commencement of the year £1634, gas sales £6213, gas-fittings £275, and residuals £1495. The chief items of expenditure were coal £5506, wages £1223, contribution to district fund £250, instalment of gas loans repaid £655, and interest £329. The rates of Sedgley have benefited during the past year to the extent of £750 from the profits of the gas undertaking, and public lighting has cost £446.

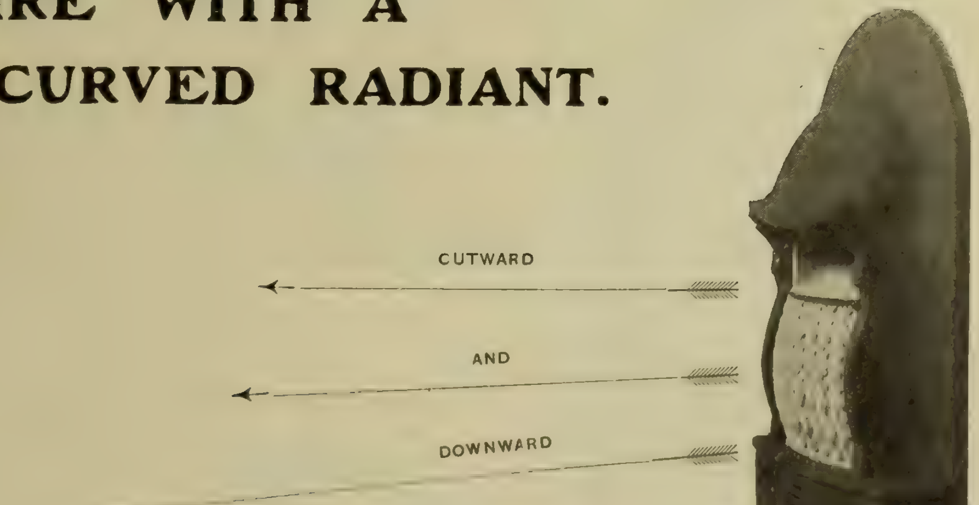
Home Office Reply to a Lighting Petition.

The desire of the Worthing Corporation to secure a modification of the Government restrictions as to public and private lighting, has led to the writing of a letter to the Home Office by the Town Clerk, who pointed out that, under the regulations as to lights in the prohibited area from Northumberland to Dorset, the streets of Worthing would be in absolute blackness one hour after sunset throughout the winter ; and that as the hour of sunset in December is about 3 50, this means the practical cessation of business at 4.50 p.m. The Council, while fully alive to the importance of assisting the authorities in every possible way, suggested that, if the police and the military have no objection, the order might be modified so as to permit of subdued lighting until 6 p.m. during the months of November, December, and January. This would allow the street-lamps to be lighted, and also business people, and particularly shopkeepers, to keep their premises lighted an hour longer. He added that it was not intended that any modification shall be allowed to interfere with the restrictions as to lights showing at sea. A reply has since been received from the Home Office stating that the question of amending the order for the winter months has recently been under consideration, and that no hope can be held out of any relaxation of the present restrictions. As regarded street lighting in the parts of the town where lights were not visible from the sea, it was pointed out that the present order permits the use of street lamps of low power where, in the opinion of the chief officer of police, a light might be necessary for the public safety.

Improvements at the Burslem Gas-Works.—By a large majority, the Stoke-on-Trent Federated Council have adopted, on the recommendation of the Gas Committee, a scheme of improvements at the Burslem Gas-Works. The Committee reported that at the close of the last financial year these works showed a balance of £4370 to the credit of net revenue account, but that considerable expenditure was needed, which would absorb the greater part of the balance, if the risk of breakdown and stoppage was to be avoided and efficiency maintained. They stated that the estimated cost of the necessary work was £3750. Some of the Burslem members protested against the appropriation of the balance in this way, and contended that it should be used in great part towards a reduction in the price of gas in the Burslem area.

An Obvious Advance.

A FIRE WITH A
CURVED RADIANT.



A Maximum of PURE RADIANT HEAT.

The "LANCET" says "This fire showed no escape of combustion products into the room whatever."
The "LANCET," June 12th, 1915.

MANUFACTURERS
THE VULCAN STOVE CO., Ltd. EXETER.

A Sign of the Demand for Coke.—Some complaint was made at a Barry Education Committee meeting that school children sent to the gas-works for coke at 5.30 in the morning did not return in time for school. The Chairman stated that on one occasion women were outside the gas-works as early as 3 o'clock in the morning, in order to get the first tickets when the works opened at 6.30. Mr. Williams said it was a common occurrence for people to be there at 4.30 a.m.

Mansfield Gas Undertaking.—At a meeting of the Mansfield Town Council last Friday, the Mayor (Mr. T. Smith), as Chairman of the Gas Committee, was enabled to make the satisfactory announcement that the Committee had been successful in prevailing upon the colliery companies to grant a reduction of 6d. per ton upon the price for coal—an abatement which would be very useful. The Committee, he also stated, were now obtaining a good price for sulphate of ammonia—something like £5 more per ton than the average was a year ago.

Worksop Water-Works Management.—Since the resignation of Mr. G. Heaps, the Worksop Water-Works Manager, some three months ago, the undertaking has been controlled by the Surveyor (Mr. G. Rawson). At a meeting of the Council last week, the Water Committee proposed that Mr. Rawson be granted £25 for preparing plans of the proposed extension of mains, and for his services as Water-Works Manager *pro tem.* The Committee also recommended that he be appointed Manager, and that the Clerk be responsible for the financial part of the undertaking. The question of remuneration had been discussed by the General Purposes Committee, who recommended that the Surveyor be paid a salary of £50 per annum as Water-Works Manager, and the Clerk £25 per annum for his services in connection with the undertaking. The Chairman (Mr. F. S. Whittell) said the Council would save at least £150 a year in salaries. Furthermore, instead of the £4600 scheme proposed by the late Manager for extensions, the Surveyor found that an expenditure of £500 would meet all requirements. The recommendations were agreed to.

Fatality at the East Greenwich Works.—John Boakes, a private in the Mechanical Transport Section of the Army Service Corps, was driving on a steam-waggon in the grounds of the East Greenwich works of the South Metropolitan Gas Company when he met with a fatal accident. Approaching a corner where the view was obstructed, he heard a light engine coming, and as soon as he realized the danger shut off steam and jumped from the waggon. He was, however, caught by the buffer of the locomotive and pinned against the vehicle. At the inquest, it was stated that deceased did not sound the hooter on approaching the corner. The yard foreman said there were warning boards all over the works; and in his experience he had never known an accident similar to this. The Jury returned a verdict of "Accidental death," and, with the Coroner, gave it as their opinion that there should be a man placed at the scene of the accident to warn locomotive drivers as to other traffic. Mr. Washington, who appeared for the Company, expressed sympathy with deceased's relatives, and said he was sure the Company would take notice of the suggestion.

Increased Water Supply for Lancaster.—Owing to the development of munition works at Lancaster, it is necessary to provide an increased water supply; and the Corporation Water Committee have decided to apply for powers to spend £80,000. It is proposed to utilize the existing Corporation reservoir at Abbeystead. The scheme provides for the installation of four new filters; accommodation having been made when the original plant was put down for an increased quantity of 750,000 gallons. The scheme of the Committee was confirmed by the Town Council at their last meeting.

The Halifax Finance Committee have approved a proposal of the Gas Committee to accept a tender, at a cost not exceeding £1000, for new plant which was not contemplated in the year's estimates.

The York Gas Company have asked consumers to limit their use of gas by burning only the most necessary lights and saving in cooking and heating as much as possible. The Company have intimated that, owing to circumstances arising out of the war and the shortage of labour, it will be necessary temporarily to restrict supplies of gas.

Monday of last week was the 36th anniversary of a great explosion at 4 o'clock in the morning at the Bradford Corporation gas-works in Thornton Road, when damage to the extent of nearly £6000 was done at the works alone. Two men lost their lives, and the shops in the city closed because they could get no light. Some days elapsed before a proper gas supply was restored.

The "Western Mail" says that both the electric light and the gas undertakings of Cardiff claim that there has been a great increase in the use of artificial light. So far, the earlier closing of shops does not appear to have had any influence towards a decrease; and there is no evidence of war economy in this direction. The increase is evidently a natural one, mainly due to growing trade—a growth purely of a natural evolutionary kind.

APPLICATIONS FOR LETTERS PATENT.

16,088—NELSON, L., "Gas-producers." Nov. 15.

16,097.—SWANSTON, F. J., "Controlling lamps." Nov. 15.

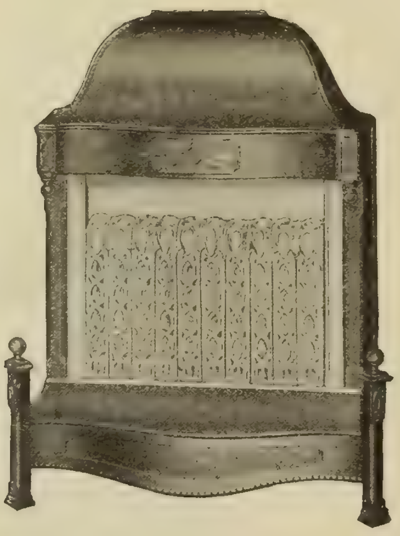
16,108.—WELLINGTON, S. N, "Discharging and quenching coke." Nov. 15.

16,261.—PEARSON, S., AND SON, LIMITED, and SMITH, J. S., "Production of toluene and its homologues." Nov. 18.

16,269.—WHITE, A. E., "Coal-gas generating apparatus." A communication from the Riter-Conley Manufacturing Company. Nov. 18.

16,348.—LEWIS, G. P., "Production of benzene, toluene, xylene, and other hydrocarbons." Nov. 19.

16,380.—HARRISON, W., "Mantles." Nov. 20.



THE "HADDON."
(The "Chatsworth" is of similar design, but with a square top.)

Made in 14-inch and 17-inch sizes.

INCREASED HEATING EFFICIENCY
is obtained with
PARKINSON
'HADDON' and 'CHATSWORTH' FIRES
by means of a
New Development
in Brick and Fuel.

Parkinson's Burner gives a perfect flame and is absolutely silent in action.

THE PARKINSON STOVE CO., LTD.,
Birmingham, and 129, High Holborn, London, W.C.

STOCK MARKET REPORT.

The Stock Exchange had an interesting week; for on Tuesday the minimum prices in Consols and Annuities, and some other minor groups, were abolished, and market values in these were left to find their own level. Aided by the increasing cheerfulness with which our prospects in war and politics were regarded, the changed conditions appeared to work quite satisfactorily. From the quotation of 57-58½ on the first day, Consols steadily progressed, until on Saturday 61 was the figure marked several times. The War Loan kept in step, and 97⅞ was more than once touched before the close. The last half of the week especially showed a very good tone pretty well all round. The long-suffering Home Rails were in a much stronger condition, Americans improved, and large traffic returns made Canadians highly popular. In the Foreign Market, Russian, Japanese, Chinese, and Brazilian issues were prominently firm. South Africans were better. Among the Miscellaneous, shipping continued to advance, and Bank shares attracted attention; but the public exhibited some prudent measure of caution in regard to rubber. Taken altogether, the tone of the week was decidedly satisfactory. Internal smoothness in the working of business was promoted by the Committee relaxing some regulations in regard to bargains; and thus certain obstacles are now smoothed out. A good deal of discontent was manifested by a considerable number of members at the large and growing quantity of business effected by the public through their bankers, who are accustomed to halve the commission with the brokers; and they urged that the bankers' share should be one-third at most. The agitation, however, is not generally considered advisable. Business in the Gas Market had something of a recovery in point of activity—some of the less prominent issues coming into notice. No pronounced general tendency was observable; some marks being a shade higher, and others a shade lower. In the Money Market, short loans were always obtainable at easy rates, but discount terms became a little firmer. The higher rate of interest carried by Treasury Bills produced a demand.

Bargains done for cash during the week were as follows: On Monday, Alliance and Dublin 69, Gas Light ordinary 75¼, 75½, 75⅝, 75¾, 75⅞, 76, ditto maximum 60, ditto preference 73½, Monte Video 9⅝, Primitiva 2 11/16. On Tuesday, Gas Light ordinary 75, 75¼, 75½, 75⅝, ditto maximum 60, 60¼, ditto preference 73, 73½, ditto debenture 62, 62⅜, 62⅝, ditto 10 per cent. bonds 194½, 195, Monte Video 9¾, Oriental 102, Primitiva preference 3 11/16, 3⅞, South Metropolitan, 76, 76½, 76¾. On Wednesday, Alliance and Dublin 69¼, Gas Light ordinary 75½, 76, Imperial Continental 73, Primitiva 2⅝, Tottenham "B" 97½, 97¾. On Thursday, Gas Light ordinary 75, 75½, ditto debenture 62⅜, 62⅝, Oriental 104¾, Primitiva 2 9/16, 50s. 9d., 52s. 3d., Tottenham "B" 97½, 97¾. On Friday, Brighton and Hove original 171, 172, Gas Light ordinary 74½, 74⅝, 74¾, 75, 75¼, Imperial Continental 78, South Metropolitan 77. On Saturday, Gas Light ordinary 74½, 75 11/16, 75, Ilford "B" 99, 99½, 100.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	69—69¼
874,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	4/6	Bombay, Ltd. . . .	5⅞—6⅜	5 17 8	..
60,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c. . .	29—30	5 6 8	..
873,480	10	"	7	7/-	B 7 p.c. .	15—15½	4 10 4	..
95,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Deb. . .	..	—	..
880,000	Stk.	Feb. 26	†14	76/-	Brentford Consolidated	261—266	5 5 3	..
830,000	"	"	†11	55/-	Do. New . . .	204—209	5 5 3	..
50,000	"	"	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb. .	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	171—172
244,200	"	"	8	7¾	Do. A Ord. Stk. .	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref. .	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb.Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	"	"	5⅓	46/8	Do. 3½ p.c. do. .	103—105	5 1 6	..
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk. . . .	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk. .	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord. . .	98—102	4 15 6	71½—76
2,600,000	"	"	3½	3½	3½ p.c. max. .	76—79	4 8 7	60—60¼
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10	73—73½
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	62—62⅝
130,000	"	"	10	10	10 p.c. Bonds .	..	—	194½—195
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C . . .	151—154	5 2 4	..
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0	99—100
65,500	"	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	5 12 6	73—78
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7		Liverpool 5 p.c. Ord. B	146—148	4 14 7	..
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb.Stk.	..	—	..
75,000	5	June 11	6	4/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	6 13 4	9⅝—9¾
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con. .	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2	102—104¾
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7½—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B . .	128—131	4 19 3	..
100,000	50	"	12	60/-	Do. C . .	118—121	4 19 2	..
52,000	50	"	10	—	Do. D . .	..	—	..
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	6 13 4	50s. 9d.—2 11/16
499,960	5	June 26	5	2/6	" 5 p.c. Pref. .	4¾—5	5 0 0	3 11/16—3⅞
521,600	100	June 2	4	4	" 4 p.c. Deb. .	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	"	"	10	10	Do. B	222—224	4 9 3	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	76—77
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	"	"	5	5	Do. 5 p.c. Pref. .	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent. .	..	—	..
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c. .	135—138	5 8 8	..
742,275	"	"	6	6	B 3½ p.c. .	115—117	5 2 7	97½—97¾
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/8	55/1½	" C 3½ p.c.	110—115	5 2 0	..
352,000	"	"	6⅛	57/6	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	"	"	6⅝	63/9	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

The recruiting movement has so seriously depleted the staff of the Colwyn Bay Council, that recourse has had to be made to the employment of women in the Gas Department. It has been decided to engage two women to act as meter inspectors and slot-meter collectors; the remuneration to be £1 per week.

The Southend-on-Sea Gas Committee proposes to grant a war bonus of 3s. per week to all married employees (other than the Gas Manager), except in the case of men of military age, when the bonus is to be granted only in the event, and from the date, of their enlisting under Lord Derby's grouping scheme.

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Rotherham Gas Department. Tenders by Dec. 13.

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Calcutta Corporation. Tenders by Feb. 21.

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Leicester Gas Department. Tenders by Dec. 11.

Tar.

Shotley Bridge Gas Company. Tenders by Dec. 8.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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VOL. CXXXII., No. 2743.] TUESDAY, DECEMBER 7, 1915. [67TH YEAR.

EDITORIAL NOTES.

The Request of the Ministry of Munitions.

ENERALLY speaking, local authorities throughout the ountry have taken in true patriotic spirit the request of the inistry of Munitions that they should do "everything in their power" to prevent attacks being made on gas underakings, owing to any deterioration of the gas through the equirement for as much benzol and toluol as possible for e purpose of making the explosives that are essential the victory of this country and its Allies. It was sugested that one form the protection should take should be y avoiding publicity of any infraction of statutory obligaons as to illuminating power or calorific value by ceasing to st the gas, or by preventing the results of tests being made ublic. That is all. The local authorities are not asked to bstain from arraigning, or obtaining penalties against, gas ndertakings for any infringement of their statutory qualitave obligations; the power of local authorities in this reect is suspended, where benzol and toluol extraction is proeeding, by the Ministry of Munitions under certain powers onferred by the Defence of the Realm Act, which may e exercised concurrently by the Minister of Munitions by irtue of the Ministry of Munitions Act. Neither is the ermission of local authorities sought as to the recovery y gas undertakings of benzol, toluol, xylol, or other contituents from the gas. This is a matter in which duty, atriotism, and command, leave no choice to those conolling gas-works. And if compliance with the requireient of the Ministry of Munitions is not sufficient to yield n amplitude of the necessaries of which coal carbonizaon processes are the sources, then the Government have ays and means of compelling further compliance, just as ey have found decisive means of doing other things that re requisite to the prosecution of the war. We are quite ertain of this, that the public, almost to a man, would not, informed of the facts, impose (if the power existed) any bstacle in the path of the performance of a service which as essential to the carrying on of the war as men and oney. We should hesitate to think, too, that there is nywhere in the country a local authority with a majority of embers who object to do everything in their power to proect undertakings that are engaged upon such indispensable ervice for the nation as are gas-works at the present time. f there are any such men upon any of our local bodies in ese days of national crisis, then they ought to be thoroughly shamed of themselves, and their constituents ought to heap pon them the contempt they richly deserve. What the inistry of Munitions is doing in this matter is being done nder the Defence of the Realm Act—an Act that has very ide application.

Most urban authorities have complied with the request f the Ministry of Munitions to the extent of declining to aise even a particle of local suspicion by public reference the communications. The matter has been treated holly with judicious privacy. There are, so far as we ave seen and heard, only isolated exceptions to this—ristol and Wandsworth; and from both authorities, there as been publicity which should have been avoided in carryng out to the full the desire that everything possible should e done to protect the local gas undertakings from attacks. he Bristol Sanitary Committee especially is censurable; or if certain members had deliberately set themselves to tart an agitation among the public, they could not have hosen a method that was better calculated to be effective. he Bristol public, however, we hope will appraise the ction in a proper way, and will show their good sense by pplauding rather than in trivial manner harassing a Comany who have already extremely heavy burdens to bear in onsequence of the war, and who are obtaining no material elief from those burdens in consequence of what they are oing to provide the nation with essentials to victory.

Both the Bristol Sanitary Committee and the Wandsworth Borough Council have decided to continue to test the gas; but the latter have resolved to do so fewer times, and at a proportionately less cost to the Council. There is no objection to this; the objection is to giving publicity to the matter—a publicity that has had large circulation through the daily and local newspapers, and even the "Commercial "Supplement" of the "Electrician" has gone out of its way to call attention to the matter. We protest strongly against this newspaper action, and hope that the Ministry of Munitions will take steps to prevent its recurrence. The Chairman of the Bristol Sanitary Committee (Alderman Lloyd) stated that he considered it was their duty to continue to test the gas. There is not the slightest harm in testing the gas for information purposes; harm could only come from any public use made of the results of the testings. But the use of such results to the detriment of the Gas Company would not have comfortable issues for those who are responsible. However, Alderman Lloyd went on to say (according to a report in a local paper) that the whole community would be affected; and the Committee would not be doing their duty unless they continued to test the gas. Supposing gas undertakings generally refused to comply with the request of the Ministry of Munitions to extract what is required for the making of explosives, supposing the Government had no power (which, of course, they have) to compel them to comply, it would be not only the community of the city of Bristol that would be affected, but the whole nation; and, instead of victory, national disaster would be the consequence. There is no question, from what has been already quoted and from what ensued, that one of the members of the Committee (Mr. Curtis) truly put the position when he expressed the opinion that some of his colleagues were approaching a national matter in a parochial spirit; and he demurred to the continuance of this attitude.

The most regrettable and objectionable feature of the attitude has yet to be referred to; for it is easy to see, from various remarks that were made, the end to which certain of the members of the Committee are driving. It is to the securing of a reduction in the price of gas in respect of any depreciation of quality that may result from working in the national interests as other gas undertakings are doing in all the big cities and towns, without any such paltry suggestion being made. If the Bristol Corporation had been owners of both gas and electricity works, and not of the electricity works only, nothing would have been heard of this matter, any more than it has been heard of in Manchester, Birmingham, or Leeds. However, Mr. Billing (according to the locally published report) said: "The quality of the gas "would be affected. They ought to get a reduction in "price." Is this what Mr. Billing calls complying with the request of the Ministry of Munitions, that everything possible should be done to protect the Gas Company from attacks in consequence of what they are doing for the nation? If so, we pity the narrowness of his interpretation of very plain words. He went further than that in making what we can only regard as indiscreet remarks which might have a bad effect on the public mind in some quarters—thus doing precisely what the Ministry of Munitions asked should not be done. The local report attributes to him the further words: "It was obvious that, if certain things were "taken out of the gas which reduced its effectiveness, the "consumers should receive some compensation." Later on, too, he gave notice of this motion: "This Committee "are anxious to adopt the suggestion of the Government as "to altering the quality and present mode of gas supply, "and would ask the Gas Company to supply the Committee "with information as to the effect of the alteration in cost, "heating, and lighting standards for consideration at the "next meeting of the Works Sub-Committee." Reading these various remarks, we cannot avoid the impression that Mr. Billing's anxiety to "adopt" what the Government are requiring in respect of benzol and toluol extraction was not extended to their request that he, as a unit of the Bristol City Council, should do his part in protecting the Gas Company from attacks. Such protection is not to be promoted by remarks such as he made, and which found their way into the local papers. However, it so happens that the Government are "top-dogs" in this matter, and not the Sanitary Committee of the Bristol Corporation.

Apart from the patriotic interest of the public, as a matter of fact the gas consumers will be but moderately affected in respect of quality. Mr. Billing seems to have wholly prejudged the matter without possessing any very definite knowledge concerning it. The communication from the Ministry of Munitions appears to have aroused in his mind the view that something really bad was going to result to the gas supply. Let us repeat his words as reported: "It " was obvious that, if certain things were taken out of the " gas which reduced its effectiveness, consumers should re- " ceive some compensation." The communication from the Ministry of Munitions was not intended to have the effect of giving an idea that something serious was going to occur to the quality of the gas; it was intended to protect the gas undertakings against any uncomfortable consequences from any fortuitous lapses below standard, and to give them confidence in working for as large a yield as possible of what our Army and Navy now so urgently require. The only consumers of gas who may notice a difference are the antiquated folk who in these times use uneconomical and inefficient flat-flame burners. The percentage effect of the recovery process upon the calorific power of the gas being small, all other users for all other purposes will not appreciate that there is any difference in the gas. Gas companies are paying a heavy price for their coal, oil, and other materials, pitch is practically unsaleable, the light oils of tar are in good demand, but the balance is not going off so freely as gas undertakings could desire. Lighting consumption is hindered. They have their increased financial responsibility in respect of taxes, and higher charges for labour. In many other ways, they are affected by the war. Amid all this, and while helping to meet a national emergency, there comes the claim that if thereby the quality of the gas is reduced there ought to be compensation. The Government are paying moderately for toluol; but, if it were not for their patriotism, and the requirement of a power that cannot be refused, there are some gas undertakings that would be better off by not working the process.

These are unusual times; and let those who are members of local authorities take a broad view, and treat them as such. Thank goodness for the national spirit that almost generally prevails among them.

The Conversion of the Thriftless Worker.

The financial and economic position of the country, and the need for national economy, are subjects that are riding high in the minds of thoughtful people. They have formed the topic of numerous newspaper and magazine articles, and for many speeches in the House of Commons and from the platform. They also supplied the entire composition of the speeches of three Cabinet Ministers at a meeting, last Wednesday, of a thousand leading representatives of trade unions and other societies, with an aggregate membership of four millions. The objects of the speeches were to urge greater economy upon the workers of the country, to enjoin them, in the interests of the State and of the poorest sections of the community, to abstain from asking for further increases of wages during the war, and to appeal to them to save, and to devote by investment their savings towards helping the country in these times of enormous financial pressure. The lines and substance of the appeals were good; but they conclusively showed that the Government understand the working classes of this country just about as much as they understood and realized the need for an abundance of high explosives before the country embarked on this war. They do not know the working classes, and they do not appreciate the needs to make of them generally better citizens through thrift, and to induce them to put forth greater effort to help in the economic work of the nation.

What the Government are seeking to do is to suddenly revolutionize the habits of the wage-earning classes. In this they have a serious and difficult task, which will not be so speedily accomplished as they could wish. The gas industry is a large employer of labour; and the gas industry knows from experience that the notions of the Government as to producing among workers immediate economy and savings, and the putting of the money, by investment, at the disposal of the country, are doomed to failure. The working classes have their own modes of life, just as have other classes. There are well-paid workers; there are those who are miserably paid; and between the extremes are the others. There are well educated and highly respectable people at all the wage-earning levels; even among the most poorly paid they are to be found. On the other hand, among the best paid, there are those who in their homes have lived at the rate of the most poorly paid and have squandered the rest; and among the poorly paid a large proportion have found it difficult to make both ends meet. The more intelligent and respectable section—good and poorly paid alike—are those who have put any money they could spare in the Post Office Savings Bank or other institutions which have been founded with a view to promoting providence among them. These are the people, too, who made the largest subscription through the Post Office to the War Loan, and the total of which subscription did not come up to the expectation of the Government. The habits of the people arising from these conditions are not going to be changed by any trumpet call, even though the trumpet be sounded by Cabinet Ministers. The squanderers will go on squandering; and those who have hitherto been wretchedly paid—even though they be of the 4½ millions, or about one-third of the total number—of workers who have had an average of (say) 3s. 6d. per week war bonus added to their earnings—will feel the pinch still greater, with the cost of living some 30 per cent. higher. There are those workers, too, who are receiving much more in total wages owing to the pressure in munitions factories; but many of these and their families are living up to their new-born opulence. These are the people who should be first approached with a view to economy and to saving, and the placing of money through investment at the disposal of the State. A revolution in their habits and inclinations, however, cannot be produced at command; and the same with the less fortunate of the working class part of the population. What the Government are asking them to do, a large proportion do not as yet understand; nor will they appreciate as applying to them a salient point in the speech made by Mr. Asquith to the trade union leaders: "Any excess either of profits or " wages which does not find its way back to the State in " loans or taxes, or is not employed in necessary industries " and public services is so much loss to the national " revenue and national resources, and therefore so much " injury to the national cause."

Whose fault is it—in no small part—that there is not appreciation and practice of economy and thrift more largely among the well-paid part of the working classes, and that there is an unpreparedness among them to assist the State financially in the present crisis? The Government, who have not hitherto bestirred themselves in any way to give proper encouragement to workers to save and create a larger independence for themselves, now suddenly exhort them to promptly change their habits, and to save and to lend the money to the State. There has been no Governmental preparation for this in times of peace; and now, in the time of war, there is no likelihood of producing a sudden conversion. Mr. Asquith, Mr. M'Kenna, and Mr. Runciman have no cause to preach to the already thrifty workers. Their savings have long been at the disposal of the Government; and there would have been much more if the Government had years ago taken in hand the creation and promotion of thrift generally among the working classes, by giving them the opportunity to invest money safely and secure a better return than is to be realized by money deposited in the Post Office Savings Bank—a return giving on their savings the same encouraging interest that the man of greater affluence can get for his money in safe securities. For this lack of past encouragement, the Government must blame themselves; if there is not a ready response to their present appeal, they must attribute it to their own short-sightedness. They have spent no end of time and money on social legislation. In connection with the country's workers, there outstand the Employers' Liability and Compensation Acts, the Old Age Pensions Act, the Mines Eight Hours Act, and the Health and Unemployment Insurance Act, in regard to the working of which last-named there is now to be inquiry. But they have neglected all plans seriously to promote thrift, and an ambition among workers to become owners of capital. The Government have been asked time after time to help forward the co-partnership movement, but they have remained lists, preferring to spend time on their own pet schemes, ich are not helping in the present emergency. The glect is coming home to roost, just when financial help every section of the public is urgently required.

The proof of the inappreciation of the Government as to futility of urging prompt conversion to thrift and invest-ent lies in the appeal itself. Co-partnership (not simple ofit-sharing) is an educational and encouraging scheme to succeeding ends of economy, saving, and investment. it the South Metropolitan Company—the pioneers of co-rtnership in the gas industry—could tell the Government at its educational work was not accomplished and did not ar fruit in a day. Platform utterances, and circulation of ints of speeches, did not produce present achievement; t years of steady, plodding work (often the results were heartening), and the encouragement given to the men the inherent virtues of the scheme, were essential. The rk and encouragement eventually bore good fruit. In-easing numbers of workmen left the whole of their bonus th the Company, for the purpose of buying stock; the ssession of a small amount of stock (on which the same idend is paid as is received by the largest investor in the mpany) created the desire among many of the men to n still more, and private savings were soon finding their y to supplement bonuses, in order to help to hasten the xt purchase of stock, and the securing of more dividend. thing better we think could be produced than the experi-ce with co-partnership to show the Government that there little likelihood of the realization of their hopes as to the dden conversion of the habits of that section of workers ong which exist uneconomy and waste, so as to put them the position to assist in succouring national finance in ese days of stress. Much time for education is required, couragement must be given, and first results would then ld their subsequent increase. The history of the develop-ent of co-partnership would have to be repeated. If here-er there is ground in the meagreness of the response for appointment on the part of the Government, then they st blame themselves for putting off to the day of necessity recognition of their lost opportunities among the work- classes in times of peace, when the important facilitating ndition existed that living cost less than it does now.

Technical Development of the Coke-Oven Industry.

UBLICATION is made in our columns to-day of the complete xt of the Presidential Address of Mr. George Chrisp, of the alton Main Colliery, to the members of the Coke-Oven anagers Association, whose first meeting was reported our issue for Nov. 16, and commented upon in that for ov. 23. The address was peculiarly appropriate to the augural occasion, in that it traced the road along which coke-oven industry has technically developed. It has en a long road; but in the last three decades the pace development has been so accelerated that the position day is a notable one, and affords an excellent basis for e building-up of still greater perfection. Above all, it is ear the beehive oven must go. Mr. Chrisp referred to e difficulties that have been experienced in this country changing from the beehive to the bye-product plants. ese difficulties have been largely due to the users of the ke, who have continued to entertain an unaccountable ncy for the product of the old oven as compared with at of the newer type—"unaccountable" when all the facts e taken into consideration. Where bye-product coke is operly made, there is no substantial chemical difference tween it and coke of the beehive process; and proof at the qualities of iron and steel are not deteriorated by e use of bye-product coke is found in its use by many the iron and steel manufacturers of front-line reputa-on. Any difference that does exist is due mostly to the riation in the composition of the coals carbonized. But r. Chrisp says it is incontrovertible that, treating the me coal by the two processes, the old system produces ke containing less ash than the new system. But coal ashing has come to the aid of the bye-product oven in this nnection; and washing is not an expensive operation—d. per ton is a figure that has been quoted. Now where operly supervised bye-product ovens work in conjunction th auxiliary plant contributing to the improvement of the ke, and a good variety of coal is used, there is no reason y the most hardened upholder of the beehive product ould not be converted, and have his bias removed. The President acknowledges what no one can deny, that the beehive plant is wasteful, and that the difference between the coke of that and the bye-product plants is insufficient to justify the perpetuation of the waste. Of course, the President does not pretend his address is complete as a review of the history of the coking industry. The industry is too vast, its processes too important, and its technical and commercial ramifications too great for its history to be compressed into the length of a presidential deliverance. There is much more to be said than Mr. Chrisp had time to say; but it makes a good summary of technical progress to be able to point, in the result, to the production of good class metallurgical coke, to the ability to utilize inferior coal, to higher yields, to economy of labour, and to the rescue of valuable materials from the lamentable waste that formerly proceeded. Yet how much there is yet to be done to attain maximum efficiency!

An Imposing Inquiry Circular.

THE circular-inquiry nuisance is one of those things that will in all probability have eternal life, with occasional dormancy. The reason for this view is that we cannot imagine such a blessed time being in store as when the picker of other men's brains by this means, and when people who are incapable of forming judgment for themselves, will cease to exist. The pest, however, allows relief for a time by remaining dormant; his consideration in this respect being due not to choice, but to the then current bad odour in which the practice stands through the antagonism aroused by its rather extended exercise. There has been a revival of the trouble of late. We have had the Stoke-on-Trent Corporation and the Slough Gas Company attempting to pry into the rates of pay of gas engineers and managers in other towns, as though, as in the case of unskilled labour in a district, there was a market rate for official services, varying only according to the conditions and output of works, without taking into account talent, capacity, or anything else. From Huddersfield, too, there was sent an inquiry circular regarding public lighting; and now, on the same subject, there emanates from Margate a circular which must about have taken away the health of recipients. It is hoped those who received the circular (which was in length about as unreasonable as any we have seen, as well as in regard to the nature of the questions) did not trouble to answer the 31 inquiries. The substantial missive, which was signed by the Borough Surveyor of Margate, seems to have had an extensive circulation—anyway correspondence indicates this, as well as the fact that the covering letter was printed. In the latter, the Borough Surveyor stated that he had been instructed to prepare a report on the cost of lighting the borough; and it appears that his inquiries were put so as to enable him to make a comprehensive job in response to his instructions.

Quite one-half to two-thirds of the questions, however, were not pertinent to the subject of the lighting of Margate. How conditions of places scattered over England could bear upon the question of the lighting of a popular seaside resort is beyond our comprehension. What, too, has the sixth inquiry—"Candle Power of the Gas?"—got to do with lighting by incandescent burners? The question as to the average distance between lamps (question No. 9) is one which can best be decided by the money that the local authority are prepared to spend on the street lighting, the degree of illumination required, and therefore the size of the burners that must be employed. Margate ought to be particularly well lighted in normal times; and the average distance between the gas-lamps ought not in any way to be controlled by what is done in other places, but by local need and interest. The inquirer also desires to know the type of burner (upright or inverted) the recipient of his inquiries prefers—and why? Has not the Borough Surveyor a preference of his own? If he has, he ought to be in a position to put reasons to the preferences of others; if he cannot do so, then he does not know much about the relative merits or demerits of the two forms of burner named. Information is asked as to the consumption of gas; and the fifteenth question is: "How measured?" The inquiry is made as to "Cost per foot run of service in road?" But the crowded sheet of interrogations does not leave room for a statement as to the conditions under which the service is run. Another question is, What is the average life of service in road? The Borough Surveyor has neglected to ask how the service is laid, and the character of the subsoil. So the inquiries proceed; and if the person replying is not tired by the time he reaches the thirty-first, the Borough Surveyor gives him further latitude to say what he likes, and as much as he likes, under the heading No. 32 "General Remarks." This is where the sole reply to the circular should appear. Perhaps in some cases, though the 31 questions are left unanswered, some "general remarks" will be made. If so, they may be found more forcible than polite. This would not be astonishing; and we should not be disposed, under the circumstances, to say that the "remarks" were in the slightest blameworthy.

The Flight of Freights.

In the editorial article in last week's issue regarding the upward flight that freights had again made, the position was exemplified by reference to the rates from the Tyne to London, and the considerable influence that they were having upon the financial and business conditions of gas undertakings. We are pleased to see that the "Iron and Coal Trades Review" (although not specifically mentioning the "Journal") endorses our views in respect to this particular matter. The situation during the past week has become worse instead of better; and not only in regard to coastwise trade, but in relation to foreign business. Our Allies must be suffering immensely from the extraordinary height to which freights have been run; and so must gas undertakings abroad (both near and far) that rely upon British coal. The rate of freight from the Tyne to London last week reached 15s. and 16s. per ton; and freights for more distant ports have proceeded to figures that are beyond reproach if audacity and greed are virtues. The matter is producing genuine alarm among those who see in this condition, if it is not arrested with a firm hand by the Government, a serious menace to our overseas trade; and it is not to the country's interest that export business should be jeopardized in this way, nor that necessary imported goods should be, through this cause, raised against us tremendously in cost. This is what the "Iron and Coal Trades Review" says: "It is true, of course, that in view of our colossal war expenditure, and the needs of the Government, the prosperity of the British shipping industry is welcome; but when the prosperity exceeds all reasonable limits, and encroaches upon the welfare of other branches of business activity, it naturally calls for serious notice." Circumstances alter cases. The circumstance that it is the British shipping industry and not the coal industry about which our contemporary is writing, causes it to see things in a totally different light. If someone had told us that at some time or other we had, in connection with our comments on the coal industry, written the latter of the quoted words, we should not have been prepared to dispute the allegation.

Flaws in Statutory Control.

Though our contemporary does not apply these words to the coalowners, it does in effect proceed to boast that finesse on their part has not been killed by legislation. For instance, the steps taken to control prices in the coal trade have not, it says, realized all the hopes of the authorities. One consequence of these steps is "that supplies are naturally gravitating towards the centres where the best prices are obtainable under the Limitation Act, with the result that other localities are inadequately provided for, as in the case of London." Then, again, "the check put upon the foreign trade in order to prevent unduly large quantities going abroad, in view of the absence of any control of export prices, has not always had the full effect desired." Those who handle coal will not be at all obliged to the "Review" for pointing out flaws in statutory control, which flaws enable them to reap some uncontemplated advantage. Mentioning exports admits of further reference to the supply of British coal to Holland. There has been prior mention of the working of the Kolenbureau, to the control exercised over its operations by representatives of the Westphalian Coal Syndicate, and to the effect of this control on British trading in coal with Holland. Our contemporary states that the latest phase of this business is that a list of Dutch importers approved by the British Government is understood to be in course of preparation, and those within the fold of the Bureau are to be released; it being a condition of our continued export of coal to Holland that none from this country shall be distributed by the Bureau. Thus the British coal trade with the Netherlands appears to have been freed from German chains.

OBITUARY: HENRY O'CONNOR.

By the death of Lieutenant-Colonel Henry O'Connor, there has been removed another well-known member of the gas engineering profession, and one whose place will not be easily filled. Naturally, his loss will be most felt in Scotland, where he lived; but, at the same time, his influence was of a character which made itself felt over a much wider field. Those who knew him personally—and they were many—were all his friends; while his literary activities had won him the good opinions of an even larger circle than this. As a gas engineer, and as a writer and speaker on gas engineering subjects, he was for many years well known; and he was also for a long period prominently connected with the Volunteer and Territorial movement. All too soon—at the comparatively early age of 53—death has removed him from us; the end, which came last Wednesday morning, after a short period of illness, being ascribed to heart affection. The call of his country found him ready—even eager—to respond; and the devotion, the whole-heartedness, with which ever since the outbreak of war he performed the exacting military duties devolving upon him, was maintained, until at last his health broke down.

It was during the time when he was professionally engaged in India that Lieutenant-Colonel O'Connor (V.D.) received his first Commission as lieutenant in the Bombay Garrison Artillery Volunteers. On his return to this country, he joined the City of London Royal Garrison Artillery (V.), and later the City of Edinburgh Volunteer Artillery. He had attained the rank of Captain before 1908; and in that year, when the Forth Royal Garrison Artillery was started, he was promoted to Major. In 1907, the Volunteer Decoration was conferred upon him; and five years later, on the retirement of Lieutenant-Colonel J. M'Niel (V.D.), he was promoted to the Command of the Forth Royal Garrison Artillery. On the outbreak of war, his corps was mobilized; and he was on practically continuous duty with it until his breakdown at Carlingnose Military Hospital.

The deceased gentleman was the son of the late Mr. John O'Connor, R.I., A.R.R.A., a well-known painter and scenic artist of his time, and was himself a capable draughtsman and one of the mainstays of amateur dramatic art in Edinburgh. Although he seldom acted himself, he was an admirable stage manager; while Mrs. O'Connor was an amateur actress of outstanding distinction, until she was stricken by illness some five years ago. Lieutenant-Colonel O'Connor received his education in London and France. He was a student under Professor A. B. W. Kennedy at University College, London, and afterwards under Professor Henry Adams, at the City of London College. Having thus studied engineering, he became a pupil of Mr. (now Sir) Corbet Woodall at the Vauxhall works of the Phœnix Gas Company. On the subsequent amalgamation of the Phœnix and South Metropolitan Gas Companies, he entered the service of the latter Company, under the late Sir George Livesey, as an Assistant Engineer. The next professional engagement he secured was in India; a period of five years being spent as Assistant Engineer and Manager of the Bombay Gas Company. While there, he was appointed one of the engineering professors at the newly-formed Technical College, and was elected a Director of the Sassoon Mechanical Institute. It was, as already remarked, while in India that he first began to take an interest, destined to be life-long, in the Volunteers. Returning to England, he took up a position as Resident Constructing Engineer at the Beckton works of the Gas Light and Coke Company, under the late Mr. G. C. Trewby.

It was in 1895 that our friend went to reside in Edinburgh; for it was then that he left Beckton to join the firm of James Milne and Sons, Limited, where he had charge of the Gas Engineering Department. This connection lasted until 1908, when he relinquished the position to take up private practice as a Consulting Civil Engineer. In this way, he was able to be of much assistance to the gas industry in Scotland, his advice being frequently sought. One of the last professional engagements referred to in the Press in connection with which he figured prominently was the arbitration held to determine the price to be paid for the undertaking of the Bridge of Allan Gas Company. The hearing took place late in 1913; and he gave evidence on behalf of the Company.

To his capacity as a writer on technical matters, the pages of the "Journal" at intervals over a space of many years bear eloquent testimony; and he was the author of several books. Perhaps the best known of these was his "Gas Engineer's Pocket-Book." Another one was on "Petrol Air Gas;" and he also was part author of Hughes and O'Connor on "Gas and Gas-Works." Among much other work, he was lecturer at the Heriot-Watt and Glasgow Technical Colleges on subjects connected with gas; and he was instrumental in founding the Eastern Section of the Scottish Junior Gas Association. At many technical meetings in England, Scotland, and Ireland, indeed, he will be sadly missed. Quite recently he was at the meeting of the North British Association of Gas Managers, and a few years ago lectured on the "Inverted Incandescent Burner" before the Irish Association of Gas Managers; while he was a Past-President of the Society of Engineers, an associate member of the Institution of Civil Engineers, and a Fellow of the Royal Society of Edinburgh. Of the numerous papers he read and lectures he delivered before these and other bodies, it is unnecessary to say more than that they were always helpful, and always enjoyable; for he had a happy style, which held the attention of his audience.

The funeral on Saturday was a military one; the burial being in Warriston Cemetery.

PERSONAL.

Mr. ALEXANDER CURRIE, Assistant Gas Manager at Campbeltown, has been appointed to the managership of the gas undertaking, to succeed his father the late Mr. Dugald Currie.

Mr. W. WALTON, of Emsworth, has been appointed Manager of the Bradford-on-Avon Gas-Works. He obtained his training at Portsmouth, where he was for fourteen years, and has been n his present position for the last six years.

Mr. V. E. CHANDLER (second son of Mr. Samuel Chandler, and rother to Mr. S. B. Chandler, the President of the London and Southern District Junior Gas Association) has just been gazetted Second Lieutenant in the Royal Field Artillery. He was pre- iously a Sergeant in the City of London Yeomanry.

Mr. L. W. NUTTALL, Manager of the Gosport Gas-Works, has een appointed Gas and Water Manager at Goole, at a salary of 300 per annum. Mr. Nuttall has been at Gosport for the past ine years, prior to which he was connected with the Keighley Corporation Gas-Works for three years. He served his appren- ceship under the Darwen Corporation. There were fifty appli- ations for the Goole post.

Mr. J. W. BROWN, who some two years ago was appointed lanager of the Bridgetown Gas-Works, Barbados (West Indies), as left his position there, and returned to England with the inten- on of serving his country; and he is hoping to secure a Com- ission. Before going to Barbados, during the absence of Mr. V. Arnott, the Manager at the Cape of the South African Lighting ssociation, he took charge of the works there.

An announcement appeared in the "JOURNAL" quite early this ear, to the effect that, owing to continued ill-health, Mr. JABEZ IGHT had retired from the Board of the South Suburban Gas ompany, of which he had been a member for more than thirteen ears, during six of which he occupied the position of Deputy- hairman. Unhappily, Mr. Light has not long survived the re- ement; for he died on the 1st inst., at East Croydon, in his th year. The funeral was fixed to take place yesterday, at orwood Cemetery.

Mr. ARTHUR R. GRIGGS, who has for some time been on the aff of the South Suburban Gas Company, has been granted a mmission in the Royal Naval Air Service—thus realizing a ish he has long entertained. He is busy now at the Admiralty, d expects to proceed to the Eastern theatre of war in about a onth. This announcement will possess a twofold interest for e members of the London and Southern District Junior Gas ssociation. Their best wishes will follow him in his new work; d at the same time they will regret the loss of the paper which had promised to read during the current session.

It was mentioned in the "JOURNAL" some weeks ago that orporal JOHN HOLLIDAY, R.E. (formerly Gas Engineer at Scar- rough, and later at Hull), who had been wounded in France, as in the American War Hospital at Paignton. It is gratifying learn that he is recovering, and is already looking forward to turning to his old section at the front. Corporal Holliday is present in the Totnes Voluntary Aid Detachment Hospital, the st anniversary of the opening of which was celebrated last ednesday. The event was marked by a social gathering, in the urse of which Corporal Holliday asked the Commandant (Dr. . Chapman) to accept from the soldiers at present under treat- ent in the hospital a silver cigarette case, as a small token of the ep respect in which they held him, and the esteemed Matron ster Tregaskis) a silver photo frame and a bunch of Christmas es, as a memento of the deep regard of her "boys."

A pleasing ceremony was recently carried out in the retort- use at the Gillingham Gas-Works, when Mr. CHARLES TANNER, nior Superintendent (who is retiring owing to ill-health), was esented with a canteen of cutlery, and Mrs. Tanner with a pair silver flower vases, by the staff and workmen. The Engineer r. C. Valon Bennett), who made the presentation, paid a hearty bute to Mr. Tanner's services to the Gas Company, and his rdial relations with the workmen, and hoped that he would e for many years, and have better health. Mr. Tanner re- onded with a few well-chosen remarks, saying it almost over- elmed him to think that he had such a lot of friends around n, as was evidenced by the beautiful presents. He took this portunity to thank one and all for their kindness. He would k on the present as a token of the high esteem in which he was d by all employed at the Gillingham Gas-Works.

City of London Gas Examinership.

At a meeting of the Court of Common Council of the City Cor- ation last Thursday, a report was submitted by the General rposes Committee upon the nature, duties, and emoluments the position of Chief Gas Examiner, rendered vacant by the th of Professor Vivian B. Lewes. The recommendation of Committee was that the office be not filled, and that an ex- t adviser be retained for gas purposes at a remuneration of guineas per annum. The Committee also recommended that salary of Mr. W. W. Duffield (the Senior of the three Assistant Examiners) be increased to £260 per annum, on condition t, in addition to his duties as a gas examiner, he conducts the k of the office in Whitecross Street, and that the increase ll not count for pension when he retires. The recommenda- s of the Committee were adopted without discussion.

ELECTRICITY SUPPLY MEMORANDA.

Progress in Efficiency and Economy.

THOSE lazy electricians who have not troubled to take stock of electrical affairs for themselves have been provided in the Inaugural Address of the new President of the Institution of Electrical Engineers (Mr. C. P. Sparks) with a review of the past and present position, and with a forecast as to the lines of possible development. There is little that is new in the deliverance; but, being President of the Institution, the composition has *ex cathedrâ* rank, and so claims consideration. Mr. Sparks tells us what is ancient history, that the electrical industry started in this country on unsound lines; that it was an initial mistake to subdivide the Metropolitan area between so many supply authorities; and that through this the present situation cannot be considered entirely from the engineering point of view. The President sketched the fruitless efforts that have been made to get parliamentary sanction to put electricity supply in the Metropolis on a saner basis, though truth to tell there is not a great difference between the average costs at which service is rendered to electricity users in London and in those cities and towns where large central power stations exist. Still nobody denies that things could be improved; and Mr. Sparks is a decided moderate—and properly so—in his views as to what should be done. Of prime importance (this comes before price) is reliability of supply. When considering this, the President is against too great concentration of generating plant, but argues in favour of fewer stations than at present exist, which number 38. He evidently believes in inter-connection of the stations being the starting-point of reformation, with a power station to supplement the supply from the existing stations, and as the less efficient of these pass gradually out of use, the main power station could be supplemented by a second or further stations as required. The President points to the principal inventions that have resulted in improving the reliability of supply, and in promoting efficiency and economy. The development of the steam-turbine, and the adoption of superheated steam, and suitable condensing facilities have entirely changed the character of supply undertakings. These changes have enlarged their scope by increasing the possible size of operating units, have greatly reduced the first cost of generating and boiler-house plant and buildings, and have lowered operating costs. In connection with the distribution system, the President awards Mr. Ferranti a large measure of praise for his invention and the development of paper-insulated lead-covered cables, which have not only reduced the cost of transmission and distribution, but have largely increased the reliability of operation. When it is considered that some 40 per cent. of the capital outlay in the electric-supply business is due to distribution, of which the cost of cable represents the greater proportion, the importance of the development is apparent. All the statements as to plant improvement, of course, constitute good reading for the central station engineer who has not the points already well in his mental grasp. Mr. Sparks also makes reference to the progress in utilization. Alluding to the nitrogen-filled, or so-called "half-watt," lamp, he states that by it 2000 candle-power-hours are obtainable per unit, which declaration is clear proof that the President has not photometrically tested these lamps. Then regarding motors, he admits that with them little further improvement in efficiency can be expected; seeing that with motors of moderate power, speed, and voltage, the efficiency already reaches 85 per cent. The main efforts of designers have been devoted to reducing the weight, and thus lowering the first cost, which has fallen 50 per cent. in motors of moderate size during the last fifteen years. The other directions of motor advance have been in improved reliability and reducing the cost of maintenance.

Further Expansion of General Supply.

There are, in the President's view, four main reasons why a "large further increase" in the general supply should be anticipated, apart from the extension of electric traction, and the use of electrical energy for electro-chemical purposes. These reasons are: (1) Necessity for fuel economy; (2) extension of lighting; (3) increased range of transmission; (4) domestic use of electricity. In this connection, the President, while desiring to be taken seriously, really gets rather humorous. In respect of national fuel economy, he thinks that the centralized supply of power and heat is the way to the desired end. We agree; but it depends upon the nature of the centralized supply. His idea of attaining economy is by converting the heat energy of coal into electricity. It may be submitted that there is another form of centralized supply by means of which a greater proportion of the heat energy of the coal can be placed at the disposal of users than by first converting it into electricity. If Mr. Sparks does not know of this other way, we shall be pleased to inform him. Then he goes on to suggest that the gas-firing of boilers at generating stations will be the next step in advance; the gas being obtained from producers worked at low temperatures. This system will provide bye-products [plural] from the distillation of the coal as a raw material [singular] for other industries. But he suggests that most of the present power stations prevent this system being worked, as bye-product processes can only be successfully operated on a large scale, and with plant working at a high load factor. We suggest that these electricity generating stations would clearly be subscribing to national fuel economy by using gas coke instead of raw coal under their boilers. Then follows the absurd comparison as to candle-power-hours derived from a ton of coal used at an electricity generating station and from the gas obtained from a ton of coal carbonized at a gas-works. This was a point that was dealt with in the "JOURNAL" last week [p. 473], and sufficient was said in regard to it. As to the increased range of transmission, the President thinks that further research should allow of higher working pressures for underground cables; and that overhead lines should enable current to be more cheaply distributed outside the range of thickly populated districts.

Electric Cooking Prospects.

There is nothing that is fresh in all this as to the prospects of development for the electrical industry. It is all commonplace. But we come to where the vista is at first a pleasant one for the President. He looks at it with keen enjoyment, and then suddenly puts obscuring clouds between himself and the view. In his judgment, there is no section of general supply that opens up greater possibilities than electric cooking and heating, since, at a modest estimate, the units required would be ten times those needed for lighting! But earlier in the address, Mr. Sparks admits that 40 per cent. of the capital expenditure is absorbed in the distribution system; and later on he confesses that a low charge is essential for these purposes. The two conditions are opposed, and yet he says the low rate is justified by the high diversity factor and the large number of hours of use, resulting in a greatly improved load factor from the residential demand. If the men of the electrical industry would only take account of the large experiences of the gas-supply industry, and not imagine so much upon their own limited experience, it would be found that the demand for cooking is of a character that means peak loads at definite hours of the day, and that the demand for heating is as erratic during the winter season as are atmospheric temperatures. For the electrical industry without storage, this class of business is not all so pleasant as the President pictures for his own satisfaction and that of his professional colleagues. He does not acknowledge these drawbacks; but he does others. While, he remarks, the efficiency of conversion in the present electrical apparatus is high, and the system is an ideal one hygienically—"since there are no products of combustion"—development has been slow. And first of all, we should like Mr. Sparks to tell us what is wrong with the products of combustion in the system that is the most popular of any for cooking and general kitchen use. Are they chemically wrong? And has the use of gas-cooked food had any deleterious effect upon the health of not only this nation, but of all the nations of the world? He goes on to explain why the electrical development in these lines has been slow. Foremost he puts this: "With the present method of conversion of the heat energy in the coal to electricity, it is only possible to deliver to consumers some 15 per cent. of the heat energy in the coal." Yet earlier in the address we have the President advocating centralized heat supply by means of electricity in order to contribute to national fuel economy! Personal predilections and interests are apt to distort judgment, and occasionally, as in the case of Mr. Sparks in this instance, cause arguments to act destructively one upon the other. But the acknowledged tremendous loss of heat energy is not the only barrier to the rapid adoption of electric cooking and heating. The President finds the cost of the apparatus and its maintenance are obstacles. He believes, however, there will be improvement in these respects as soon as supply undertakings are prepared to let on hire and maintain apparatus on liberal terms, in the same way as the motor business was developed. There is little analogy between domestic cooking and heating and the motor—the conditions of use being altogether different. But to sum up. The apparatus, though costly initially and for maintenance, must be supplied on hire (including upkeep) on liberal terms; the energy must be supplied at low cost; and, if use succeeded in reaching large dimensions, the demand on the distributing system would be piled-up for cooking during certain hours of the day, and for heating on the low-temperature days of winter, which intermittent form of demand would increase both plant and distribution expenses. The commercial position does not look so bright when the technical and financial factors are examined in all their bearings. Without such examination, self-deception is very easy indeed.

Electric-Fires and Cold Weather.

We learn from "Electrical Engineering" that Mr. George Wilkinson, the Borough Electrical Engineer of Harrogate, has issued a booklet dilating on the advantages of electricity in the home. The benefits of the rateable value system—a fixed charge of 15 per cent. on rateable value, and ½d. per unit for all electricity consumed—are lauded; and consumers are informed that for water heating and like apparatus (having 100 per cent. load factor! with automatic control), current is supplied on contract at ⅓d. per unit. The information then proceeds: "As showing the advantages of the tariff, an example is given of a house in Harrogate let at £60 per annum. In 1913 the kitchen range and boiler were removed, and the house was equipped as an 'electric household' as follows: Complete kitchen arrangement, including electric cooker and automatic electric hot-water apparatus capable of furnishing a maximum of 125 gallons of hot water (at 100° Fahr.) in 24 hours. Eight rooms were fitted with plugs for electric-fires, including four bedrooms and the bathroom. One fixed and three portable radiators were provided, as well as plugs for an electric vacuum cleaner on each floor. For supplementary heating in the cold weather, a slow combustion coke-boiler was installed in the basement, and hot-water radiators fixed in the entrance and rooms on the ground and first floors. In the coldest weather, coal fires in slow combustion grates are used in place of the electric-fires in the living rooms. These labour-saving improvements allowed of one maid being dispensed with, and the actual comparative expense, taking the average of two years, on the rateable tariff, showed a saving of £10 16s. 9d. per annum." There are two points of interest about this statement. The first is that in cold weather a slow combustion coke-boiler and slow combustion coal-grates are used. This is splendid testimony to the incapacity of the electric heating method to cope with the conditions when heat is most required. We have heard a lot lately from unhygienic people about constructing houses without flues so as to favour the electric "fire." The members of this "electric household" could not manage without chimneys in the perishing days of winter. Regarding the saving of £10 16s. 9d., it will be noted that the services of one maid were dispensed with; so that when the coal fires are in use, additional work must be thrown on the remainder of the household through the absence of the one servant. This is something like Mr. Wilkinson doing without a full staff at his station at the time of maximum winter work. The "saving" is shown by a table given in the "Electrical Times" to have been due entirely to the eviction of the servant girl; and that her expense went to contribute to defraying the higher costs of the electrical methods. This means that where there is not a maid who can be shown the front door, the electrical methods stand no chance. The comparison is as follows:

One maid less	£20	0	0	15 per cent. on rateable value (£45) ..	£6	15	0
Food and maintenance	20	0	0	11,334 units at ½d. ..	23	12	3
Saving in fuel (16 weeks) at 4s. per week..	3	4	0		£30	7	3
				Upkeep and repairs, say	2	0	0
	£43	4	0		£32	7	3

For the edification of the general public, this comparison is not as explicit or detailed as it might be.

The Artful Fatherland.

We have been an extraordinarily short-sighted nation in some matters; and one of them has been in connection with German commercial strategy. The electrical industry offers pre-eminent illustration—not intentionally, but because the truth cannot be hidden. It has been generally known for a long time that the British electricity supply industry has been heavily concerned in contributing to the prosperity of Germany, and that it had received with the utmost cordiality the planting in this country of German manufacturing enterprise with German capital. It was said that this was preferable to things being manufactured in Germany. Consciences were salved by saying that buildings would be erected and equipped in this country with capital brought from Germany. The fact that most of the material and equipment would come from Germany mattered little; for would not the buildings and the businesses pay rates and taxes here, and employ labour, which labour would spend its earnings locally? See then how the country would profit. The gold shipped over to Germany representing profits on the capital employed was something about which little was said. But there is another aspect of this German enterprise which has not hitherto received the prominence it deserves; and the point is made by an "Electrical Correspondent" in the "Engineering Supplement" of "The Times." The lesson has of late been frequently impressed upon us that the most fruitful way of increasing the prosperity of the country is to enlarge our exports and reduce our imports. Germany was practising this at our expense long since. Several of these kind and beneficial German capitalized concerns were founded here for the dual purpose of getting as much as possible of the business that was going in the United Kingdom, and to protect the export trade of the parent companies, and thus of the Fatherland. In other words, these "British" companies with German capital showed their love for Great Britain by taking out of it all they could, while keeping as low as possible its export trade in electrical plant, and so by passiveness in regard to overseas trade, helping Germany to obtain and to retain it. "Electrical Correspondent" winds up his article by saying: "If there is to be a healthy patriotic spirit at work to put greater competitive power into the British electrical industry after the war, it is essential it should be clearly understood which firms stand wholly for British interest, and which are merely a kind of 'tied house.'" In other words, those firms which do not strive to increase British export trade, and in which there is German capital, should be left completely without home trade. In the national interests, such companies require freezing-out; and if they have no trade here, and do not try to get any abroad, well they will soon understand their room is preferable to their company. The British Electrical Manufacturers' Association have under consideration the question of mobilizing the energy and resources of genuine British firms for promoting their interests after their factories have seen the end of munitions work, and are again at liberty to promote ordinary business on the large scale.

A GAS-FURNACE DEMONSTRATION.

N excellent sequel to the paper read last Friday week by Mr. . W. Brooks, on the "Application of Gas to Industrial Pur- ɔses," before the London and Southern District Junior Gas ssociation, was provided on Saturday afternoon, when some rty members of the Association visited, in Goswell Road, the dustrial appliance show-rooms and demonstration workshops of e Gas Light and Coke Company, where they witnessed a number tests carried out in different types of furnaces. First of all, ɔwever, there was an inspection of the well-equipped general ɔres, under the guidance of Mr. A. H. Webber, the Inspector-in- ıarge. This concluded, the party assembled in the industrial pliance show-room, over which they were taken by Mr. Brooks ho is the Company's Special Representative) and his Assistant, r. Grover. An illustrated account of what has been done by e Company to provide facilities for demonstration purposes was ven on p. 504 of the "Journal" for June 1 last; these facilities ing an invaluable aid in bringing into the fold the increasing ımber of manufacturers who manifest willingness to consider e use of coal gas as a fuel in their factories and workshops.

Pointing out the features of the building, Mr. Brooks drew tention to the fact that the furnace-room was specially con- ucted, and occupies a floor-space of 1250 square feet. Both tural and artificial lighting are provided on a generous scale; e former by means of a glass roof, and the latter by an effective lection of high and low pressure lamps specially adapted to ctory lighting. The power and compressing plant, which is in- alled in a communicating room, consists of a 6 B.H.P. gas-engine, iving a main shaft; a Worthington reciprocating pump-acting mpressor, for supplying gas up to 15 lbs. pressure per square ch; a 1000 cubic feet Keith and Blackman rotary compressor, r supplying either gas or air at 4 lbs. pressure; and a No. 2 andard Keith high-pressure air-blower, capable of supplying ,000 cubic feet of air per hour at 8 inches water-gauge pres- re. The inlet and outlet pipes of the compressors and leads to e various furnaces are painted in different colours; and by re- rring to the gauge-board, it is easy to ascertain the pressure at ıich each appliance is working. Again, there are two 200-light y meters fitted on the floor of the demonstration room, to enable stomers to check the indices while tests are being made. The eters are fitted with bye-passes and pressure-gauges on the inlet d outlet connections; one meter supplying the natural draught d air-blast furnaces, and the other high-pressure gas.

The furnaces are of all sorts and sizes, by the leading makers; d there is also a varied selection of blow-pipes, soldering-irons, ımen's stoves, high-power burners, &c. Inquiry elicited the fact at a good many of the appliances seen both in and out of action e attributable to the inventive faculty of Mr. Brooks, who in is way proves how thoroughly he has followed the plan which recommended to his audience during the discussion on his per—that is, to take each trade separately, and endeavour to aster it, so as to find out just where gas would be useful, and, course, how it could be best burned. Some of the appliances ıich were illustrated and described by Mr. Brooks in his paper ere seen in being on Saturday afternoon.

After they had seen in action the internal heater, which has oved so useful for heating water, acids, &c., in cases where the tward application of gas would be either undesirable or impos- ɔle, some actual tests were taken with various appliances. The st were made in the low-pressure gas brazing forge, with air at inches. Here a ¾-inch small steel chisel was heated in 2 minutes seconds, with a consumption of 6 cubic feet of gas, starting t, and a 1¼-inch tool in 4 minutes 19 seconds, with a consump- ɔn of 9 cubic feet of gas. Next a move was made to the sugar ɔiler (which, again, is worked with gas at normal pressure, and r at 4 inches); and in this what proved to be an excellent ıtch of toffee was made. For this, 28 lbs. of sugar and 5 pints water boiled in 3 minutes from lighting-up; the whole process equiring a temperature of 310° Fahr.) taking about 7 minutes, ith a total consumption of 68 cubic feet of gas.

The next thing to interest the visitors was a demonstration th the oxy-coal gas welding plant, with which it is found possible weld anything up to cast iron. Mr. Brooks stated that the ɔmpany find manufacturers prefer (for instance) to use oxygen ıd coal gas for repairing motor-car cylinders, because they get a ore durable weld in this way than by employing acetylene. The ɔrk is preheated, and got up to a fairly high temperature; and this way it is considered that a finer weld results. By the oxy- ɔal gas process, it is reckoned that a temperature of about 4000° ahr. is attained. The caramel toaster—a useful little appliance -received its due meed of attention; and then an adjournment was ade for tea, on the invitation of the Company. What they had en had impressed upon the members two facts—the enterprise the Gas Light and Coke Company, as exemplified by the ad- irable equipment of the demonstration room, and the ingenuity Mr. Brooks, as displayed by the internal heater, the brazing rge, the sugar boiler, and the caramel toaster. Much interest as, of course, displayed in the large number of specialities by essrs. Fletcher, Russell, and Co., the Richmond Gas Stove and eter Company, and Messrs. John Wright and Co., which are on ew in the room. Before the party rose from the tables,

The President (Mr. S. B. Chandler) said they had had to thank ıe Gas Light and Coke Company for very many favours extended the Association in the past; and the afternoon they had just spent had been no exception to the rule which had always held—that the visit had been both enjoyable and instructive. The inspection had been specially interesting from the fact that, taken in conjuntion with Mr. Brooks's recent paper, it had given all of them both theoretical and practical experience of furnace work. The demonstrations they had just witnessed had proved that gas was able to perform what Mr. Brooks had told them it could do. Their cordial thanks were certainly due to the Directors of the Gas Light and Coke Company, Mr. F. W. Goodenough (the Controller of Gas Sales), Mr. Brooks, Mr. Webber, and Mr. Grover. He would ask the Senior Vice-President to propose a vote to this effect.

Mr. F. Pearce, in complying, remarked that, after hearing the paper Mr. Brooks had read to them, and seeing in use the different appliances for which he was so largely responsible, they could form a very good idea of the diversity of the uses to which gas could be put from an industrial point of view. In the previous session of the Association, the members paid a visit to another works, where a lot of work had been done in connection with gas-furnaces. He believed the system employed there was high-pressure gas; whereas Mr. Brooks's system was low-pressure gas and low pressure air, with which he was able to show a great saving.

Mr. D. J. Winslow, who seconded, referred to the great field which exists for this kind of work, and to the remarkably fine installation of furnaces they had seen. He was glad to note that so important an undertaking as the Gas Light and Coke Company had taken up this matter seriously. It was a serious matter. The average factory owner and foreman were very conservative as regarded the apparatus used. This, of course, was really quite natural. Manufacturers had had ample experience of heating with solid fuel; and they were not going to change unless it was clearly shown that they would derive substantial advantage from so doing. However, having taken up the question in the way they had, the next thing for the Company to do was to find a suitable man to look after things; and this he felt sure they had done in Mr. Brooks. It was very nice indeed to see so much apparatus that the man in charge was himself responsible for.

Mr. Brooks, in acknowledging the vote (which was cordially passed), said that, on behalf of the Company and of himself, he thanked them very much. They relied upon actual tests, and a careful study of the figures produced, to convince prospective customers as to the reliability and economy of the commodity they were trying to sell. This was one of the reasons for their success.

Mr. A. H. Webber remarked that it had been a great pleasure to have the members there, and to do what he could to make the visit a success.

The President subsequently announced that their late Hon. Secretary, Mr. A. R. Griggs, had obtained a commission in the Naval Air Service, and that Mr. D. Evans, also of the South Suburban Gas Company, had joined the London Rifle Brigade.

The members then returned to the demonstration room, where they spent a further hour in watching the biggest test of the day—the running-off of a melt of 80 lbs. of brass. The 80 lbs. of metal was put into a 150 lb. pot, and placed in a built-up furnace heated by Mr. Brooks's own burners, which are designed to consume gas and air at equal pressures without any governing device; the pressure during the test being in each case as nearly as possible 5 inches. The metal used was hard ingot brass, which had previously been melted about half-a-dozen times, so that, as was pointed out, it was practically as hard as copper. The unnecessarily large size of the pot, of course, was also against the test. However, starting from cold, the melting was done in 1 hour 5 minutes, with a consumption of 510 cubic feet of gas. This is equal to a consumption of about 6·3 feet per pound of metal, which, as Mr. Brooks said, might with this system be reckoned as the consumption necessary for copper. As a matter of fact, he stated that a few days previously 600 lbs. of brass had been melted, by the same system, in 2 hours 10 minutes, with a consumption of 2150 cubic feet of gas, which worked out at 3·58 cubic feet per pound of metal.

Thus was brought to a close a visit which had, without a dull moment, extended to over four hours.

Calculating the Diameters of Mains, &c.

A method of calculating sizes of high and low pressure mains services, &c., having for its object the simplification of the process' was described by Mr. George H. Elliott, Assoc.M.Inst.Mech.E., of No. 4, Rill Terrace, Exmouth, in a couple of articles which he contributed to the "Gas World" earlier in the present year. These the author has now had reprinted in the form of a handy little book, the price of which is 1s. 6d. net, and postage 3d. To the previous matter have been added a few notes to facilitate the estimation of gas consumption, most of the figures having been supplied by the manufacturers of apparatus. One chapter deals with the proportioning of services and interior fittings; and later on in the book the subject of illumination is treated simply and concisely. Here the student can obtain an explanation of such terms as the foot-candle, mean spherical candle power, the polar distribution curve, and some figures of illumination standards, reflective and obstructive powers, &c., arranged conveniently for reference. The consumptions of gas in fires, radiators, boilers, irons, cookers, and engines are not claimed to represent the absolute efficiency of gas appliances, but to be near enough to calculate the approximate consumption. Those who use the book will like to have it with them during working hours; so its small size is an advantage.

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The Law and Parliamentary Committees of the Metropolitan Water Board estimate that the cost of securing their Act last session approximated to £3000; while the Board's opposition to Bills in the session 1913-14 amounted to £834.

A CRITICAL REVIEW OF THE METHOD EMPLOYED FOR DETERMINING HEATS OF COMBUSTION.

By Stanley Robson, M.Sc. (1851 Exhibition Scholar of the Armstrong College, Newcastle-on-Tyne), Research Student in the Department of Chemical Technology, the Imperial College of Science and Technology, London.

(*Continued from p.* 479.)

IV.—Work of Julius Thomsen. [1851-1886.]

The work of Julius Thomsen,* who perfected that of Favre and Silbermann, is no less remarkable for the discrimination shown in its selection than for its quantity. The choice of material for examination was determined by the following considerations:—

(1) It must be obtainable in a pure form.
(2) It must be a gas or be readily vaporized.
(3) It must belong to a group of theoretically important substances.
(4) It must be of sufficiently low molecular weight that a reasonably accurate heat of formation could be deduced from its heat of combustion.

This last consideration confined Thomsen's researches to substances with less than six carbon atoms in the majority of cases, though some aromatic compounds with nine carbon atoms were also studied. The reason for this limitation is obvious when it is borne in mind that the whole error of the determination of the heat of combustion falls upon the heat of formation which is deduced from it by difference, and is generally a very much smaller quantity.

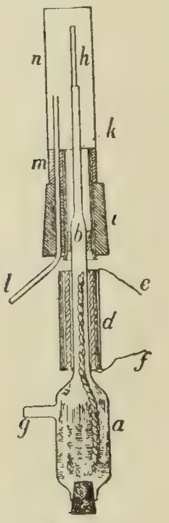

Fig. IV.—The "Universal" Burner.

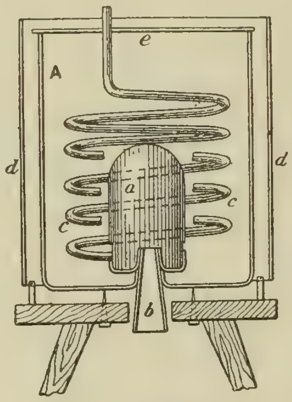

Fig. V.—Thomsen's Combustion Vessel.

Thomsen's apparatus differed essentially from Favre and Silbermann's in the discarding of elaborate jacketing arrangements for the calorimeter, and in the mode of regulating the combustion. With gases, regular combustion could only be achieved by providing against variations in pressure of the gas and the oxygen supplies, and the still more disturbing influence of oscillations in pressure, due to the bubbling of the gas and the products of combustion through liquids in the various accessory absorption apparatus. Constant gas pressure was readily obtained by means of properly devised aspirators. To provide against the irregularities due to bubbling, sections of capillary tubing were inserted in the apparatus. One was immediately in front of the entrance to the calorimeter, which prevented any back-flow of the gas; another in front of the absorption apparatus; and a third immediately in front of the potash bulb. To counteract the resistance of the absorption apparatus and the constricted areas, an aspirator [G, Fig. VI.] was introduced at the end of the apparatus. Any desired constant pull from this was obtained by arranging the level of the vessel *d*; the difference between its outlet and the lower end of the tube *a* being a measure of its suction.

The total effect of these devices was to give such a constant flow of gas through the apparatus that the water manometer *n* showed no variation in pressure. Complete control of the flame was by this means obtained, and the combustion could be maintained as nearly as possible perfect.

Thomsen made special provision for the complete combustion of volatile organic compounds. His method was to supply the vapour of these substances to the combustion vessel at a constant rate and at a constant known temperature. To effect this, an apparatus which he named the "Universal Burner" was used. This is represented in Fig. IV. The liquid to be burned was placed in a small bulb *a*, and passed up by means of a wick of purified cotton or asbestos into the tube *b*, where it was heated by means of a spiral of fine platinum wire *e*, *f* to any desired temperature. By maintaining a regular electric current through *e*, *f*, a constant evolution of vapour could be maintained, and accordingly the size of the flame at *h* did not vary. In order to prevent any condensation of the vapour in its passage from *b* to *h*, a double silver wire was introduced into the tube *h*, which, being made of platinum foil, became strongly heated, and communicated its heat to a silver wire throughout its whole length from *h* to *b*. Thomsen considered that this prevented the vapour from being cooled, and at the same time did not produce any modification in the quantity of heat that was supplied to the calorimeter.

Many substances when burned in an atmosphere of oxygen, under ordinary conditions, give rise to a smoky flame, and thus tend to block-up with carbon the orifice of the burner. Complete combustion, however, can be effected by volatilizing the substance at a suitable temperature by means of a gas. For this purpose, either ordinary air or varying quantities of oxygen and nitrogen, or hydrogen, were introduced through the opening *g* of the lower bulb. The rate of flow of the gas, and the intensity of the electric current, were then regulated until the flame was of the requisite size, and burned without smoke or the deposition of carbon. The burner was attached to the combustion vessel Fig. V. by means of the stopper *i*. The oxygen required for the combustion was admitted through the tube *l*. Next to the indiarubber stopper was a cork disc *m* of somewhat smaller diameter. This supported a platinum tube *n*, surrounding the two tubes, through which entered the oxygen and the vapour to be burned. Its object was to render the oxidation more effective; and for this purpose it was filled with glass-wool up to the lower part of *h*. The current of oxygen was regulated in such a manner that the gases leaving the combustion vessel were mixed with about 50 per cent. of free oxygen.

The calorimeter Fig. V. was not surrounded with a series of external jackets, since it was possible to arrange that the temperature of the laboratory where the experiments were carried out did not vary more than one-tenth of a degree during the course of several hours. It was, therefore, simply protected from any possible radiation from the person of the experimenter, by means of an ebonite cylinder *d* open at each end. This screen was supported at three points, and in no way interfered with the free

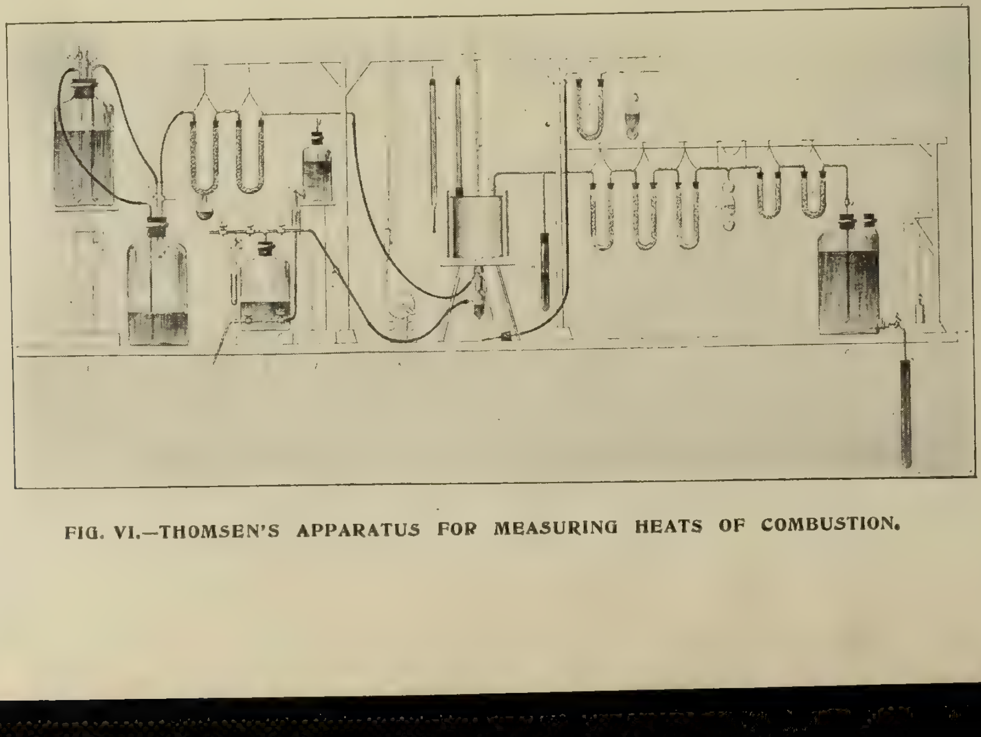

FIG. VI.—THOMSEN'S APPARATUS FOR MEASURING HEATS OF COMBUSTION.

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* "Thermochemische Untersuchungen."

irculation of the air around the calorimeter. The cover *e* was lso of ebonite.

Fig. VI. shows the apparatus completely assembled. The xygen was supplied from the constant head gasholder A, B, nd that passed through the drying tubes 1 filled with sulhuric acid and 2 with caustic potash. As the tube through hich the oxygen passed to the burner was constricted close to *a*, in order to diminish the variations in atmospheric pressure, e oxygen in B had always an excess pressure which was kept etween 10 and 20 cm. water gauge according to the adjustment the height of A. The gas under examination was stored over ercury in C D. If it contained more than one atom of carbon the molecule, it was diluted with dry atmospheric air freed om carbon dioxide, or else with air mixed with oxygen, in order at the combustion might take place without the deposition of rbon. The velocity of the gas fed from this holder was determined by the quantity of mercury flowing out of D per minute; it the tap *h* was always turned so that there was an excess presre of 2 to 3 cm. of mercury in C—this pressure being registered the manometer K.

F represents the calorimeter and its accessories already sepately described. A thermometer *g* was fitted through the lid, id a similar thermometer suspended by the side of the calorieter to register the temperature of the air. When the combusble substance contained only carbon, hydrogen, and nitrogen, e tube 3 held a mixture of sulphuric and chromic acids; tube 4 lcium chloride; tube 5, concentrated sulphuric acid—these bes retaining water vapour and oxides of nitrogen. Tube 6 was Liebig's bulb containing a 40 per cent. solution of caustic alkali; id tubes 7 and 8 were tubes containing solid caustic potash.

The following was the method of procedure: As soon as the nount of water in the calorimeter was weighed, the calorimeter epared, the stirrer and the thermometer put in their places, id communication with the absorption apparatus established, the echanical stirrer was started to allow a uniform temperature be established in the calorimeter. When working with a nonseous body, the electric current was first started in order to eat-up the burner. One or two minutes afterwards, the current air was led into the volatilizer, where a flame of the size preously arranged for was produced.

One minute after these preparations were completed, the calorietric measurement was commenced; the time being noted by eans of a stop-watch. The temperature of the air and also of the calorimeter was noted, and readings were taken at the end of the second and third minutes. At the end of the fourth minute, the combustion in the calorimeter was commenced, the universal burner being placed in the opening of the calorimeter which it closed tightly. The tube *d* of the aspirator was then raised or lowered till the manometer *m* registered a depression of 1 cm. of water, which was the desired pressure in the calorimeter.

All was then in order, and remained unchanged throughout the course of the combustion. This applied to the rate of flow of the oxygen and of the gas in the holder C, as well as to the vaporization brought about by the electric current in the burner, and to the regular working of the aspirator.

The conditions under which the combustion was proceeding were ascertained by watching the manometer, since any irregularity would be at once shown by a considerable alteration in the level of the water. An increase in temperature of the calorimeter was always found to be proportional to the time, which indicated the maintenance of constant conditions during combustion.

When the temperature of the calorimeter had risen to the required degree, the combustion was interrupted by shutting the tap *d* of the gasholder C. The burner was then removed from the calorimeter, and replaced by an indiarubber stopper, through which a glass tube was inserted. This tube was connected-up with the absorption tubes 9, which contained solid caustic potash, and 10, which contained a 40 per cent. caustic potash solution. The aspirator, working continuously, drew through the calorimeter a current of dry air free from carbon dioxide. The rate of flow was regulated by means of the tap *d* so that about 160 cc. of gas passed per minute. The apparatus was then left untouched for fifteen minutes, during which time the temperature was read every three minutes. At the end of this time, the experiment was finished; and the absorption tubes 6, 7, and 8 were detached and subsequently reweighed.

THOMSEN'S METHOD OF CORRECTING HIS OBSERVED TEMPERATURES.

Thomsen employed a very involved method of correcting for losses or gains of heat in his calorimeter. This was necessitated by the comparatively long duration of his experiments. However, the corrections are so intricate that it is impossible to discuss them here. A full description is to be found in the "Thermochemische Untersuchungen, Vol. IV., pp. 22-46."

The general equation on next page represents the method used

HEATS OF COMBUSTION—IN CALS. PER GRAM MOL. OR GRAM ATOM.

Substance.	Method of Preparation and Purification.	Experimental Values.	
Sulphur	Not given	Rhombic Sulphur. 70,950 71,220 71,080 71,080	Monoclinic Sulphur. 71,636 71,810 71,720
Carbon monoxide	Not given	67,513 67,914 68,321 68,073 67,957	68,093 67,971 68,198 67,961 67,593 67,927 67,955
		67,960	
Hydrogen	Not given.	68,388 68,467 68,231 68,357	
Methane	Prepared from sodium acetate and lime Purified by passage through sulphuric acid, nitric acid, and copper chloride	212,370 212,846 211,000 213,110 212,190 211,400 211,090 212,370 211,030 211,930	
Ethane	Prepared from zinc-ethyl and hydrochloric acid, gave on analysis $C_2H_{6\cdot080}$ and $C_2H_{6\cdot080}$. Prepared also by electrolysis of sodium acetate, gave on analysis $C_2H_{6\cdot033}$	370,640 369,720 372,330 370,900	368,180 370,180 372,550 369,480 370,100
		370,400	
Ethylene	Prepared from alcohol and sulphuric acid, gave on analysis $C_2H_{4\cdot240}$ Thomsen believed this gas to contain methane in the proportion $C_2H_4 : CH_4 = 1 : 0{\cdot}1277$	334,020 333,750 332,400 333,390	Corrected to 333,350
Acetylene	Prepared from soda lime and ethylene bromide, gave on analysis $C_2H_{2\cdot013}$	310,300 307,150 310,510 310,130 309,520	310,570
		310,050	
Benzene	Prepared in several ways by commercial firms of repute	799,980 799,930 798,490 802,180 795,480 799,218	Kahlbaum's 800,540 Schuchard's 799,860
		801,160	
Ethyl alcohol	Not given	341,260 341,180 341,110 342,040 342,020 341,370 341,670 342,400 342,130 342,090 341,790	
Carbon disulphide	Not given	263,670 265,790 264,750 266,940 265,290	
Cyanogen	Prepared by gently warming mercuric chloride and mercury cyanide	259,400 260,300 259,610 259,180 259,620	
Hydrocyanic acid	Not given	158,030 158,860 158,690 158,900 158,620	

NOTE.—The above values for benzene, ethyl alcohol, and carbon disulphide are heats of combustion of the vapours at their boiling points.

to determine the molecular heat of combustion of a substance from the experimental data.

$$R_1 = (t_2 - t_1 + \phi) A \frac{44a}{\alpha} + (\omega + \gamma) - \psi$$

R_1 = The molecular heat of combustion.

t_1 = The corrected initial temperature of the calorimeter. To obtain this the temperature was read at 4, 3, 2, and 1 minute intervals before the combustion, and was then calculated from $t_0 = t_1 + \frac{1}{2}(t_2 - t_4)$ which was derived by the method of least squares.

t_2 = The corrected final temperature of the calorimeter. To obtain this the temperature was read at minute intervals for fifteen minutes after the end of the combustion—the values at six, nine, twelve, and fifteen minutes being used and the actual temperatures given by the equation $t_0 = 1{\cdot}3t_6 + 0{\cdot}6t_9 - 0{\cdot}1t_{12} - 0{\cdot}8t_{15}$ according to the method of the least squares.

ϕ = The correction for the alteration of the zero of the thermometer.

A = Water equivalent of the apparatus.

$\frac{44a}{\alpha}$ = Factor for the reduction of the terms to gram molecules.

44 = Mol. wt. CO_2.
a = Number of carbon atoms in molecule.
α = The weight of CO_2 formed.
$(\omega + \gamma)$ = The heat lost by the evaporation of sufficient of the water formed in the calorimeter to saturate the products.
ψ = The heat lost to the exit gases and is calculated from the difference in the temperature of the exit and entering gases and their specific heats.

Little comment, other than appreciation, can be made upon Thomsen's work. For patience and skill, it has been in all probability only rarely equalled. It is unfortunate, however, that he should have been so absorbed in the construction of a science of thermochemistry; for in work of this character it is under such circumstances almost impossible to avoid bias towards experimental methods which favour the deductions made early in the course of the investigation. How far Thomsen was so biassed (if at all) is obviously unknown; but he has certainly been charged with this error.[*]

The most obvious point for criticism in his apparatus is the "Universal" burner. The presence of an external source of heat is objectionable no matter how careful its regulation may be.

A further objection which has been laid against Thomsen's work is his method of temperature correction. This, as Berthelot[†] pointed out, depends only on the theory that the temperature losses and gains vary with the excess in temperature of the calorimeter over that of the neighbouring air; any correction for the loss of heat from the calorimeter by evaporation being neglected. However, the errors due to thermometric readings are probably smaller than in bomb calorimetric methods, owing to the greater increase in temperature during an experiment.

As in the case of other investigators, the methods employed by Thomsen for the preparation of some of his gases leave room for doubt as to their purity. This is especially the case with his method of preparing methane and ethylene. He prepared methane by heating a mixture of sodium acetate and lime—a method which cannot be considered as satisfactory. Ethylene was prepared by heating a mixture of ethyl alcohol and sulphuric acid. These gases would certainly be contaminated with impurities which could not be computed by means of any method of analysis; and as Thomsen's values for the heats of combustion of methane and ethylene are nowadays accepted without question, it is necessary to call attention to them.

(*To be continued.*)

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[*] Lemoult. Ann. Chim. et Phys.

[†] Compt. Rend., XC., p. 1241.

Separating Water Gas into its Constituents.

The specification of a patent taken out in Germany in 1913 by the Badische Anilin und Soda-Fabrik is abstracted in the "Journal of the Society of Chemical Industry." It is pointed out that if water gas or similar gaseous mixture be compressed and then allowed to expand, the lowering of temperature produced is not sufficient to liquefy the constituents other than the hydrogen present in the gas. The invention referred to consists in adding carbon monoxide or nitrogen, which show a positive Thomson-Joule effect, to the gas, before compression, in such proportion that the lowering of temperature produced on expansion is sufficient to liquefy the major portion or all of the constituents other than hydrogen. The enrichment of the gas in carbon monoxide or nitrogen may be effected by modifying the method of preparation, or by adding a suitable gas to the gaseous mixture containing hydrogen. When the process is once in operation it is only necessary to add a certain quantity of the constituents (carbon monoxide, nitrogen) which are liquefied, to the gas under treatment, in order to obtain the desired result; or the liquefied constituents may be fractionated and the most volatile portion, still containing some hydrogen, added to the gas under treatment.

COKE AND OTHER MATTERS.

By "Qui Vive."

Now that it is so difficult to transport coke from one district to another, it is more than ever necessary to dispose of the whole of the production in the neighbourhood. This may seem, and undoubtedly is, a tall order in some districts; but, even so, it is frequently the fault of the management, who have persistently given the matter insufficient attention.

With railway waggons so much in demand for the transport of war material, there will be very little temptation to dispose of a surplus coke stock in other districts—which is all to the good, at any rate, from the point of view of developing local trade. To induce a manufacturer or other large fuel user to transfer his custom from coal to coke may rightly be looked upon as a triumph; and such development work should be strongly encouraged by the local authorities in the interests of smoke abatement. Unfortunately, however, it is too often the case that these same authorities are themselves, collectively or individually, offenders in the matter of smoke production, and shrink from taking any steps in a matter which will show up their own delinquencies.

Parliamentary War Savings Pamphlet.

To push coke at the present time no better means could be suggested than that of distributing the leaflet prepared by the Parliamentary War Savings Committee, which strongly advocates the use of coke instead of coal. It is true that this is addressed to householders; but anyone perusing it, whether he be a householder or manufacturer, would realize that it was equally applicable to either, and, further, the fact that it is authoritative advice makes it the best possible advertisement. Seeing that it urges the use not only of coke but also of gas, there is every reason for making capital out of this official pamphlet, as by doing so one is not only helping oneself but the Government as well. Its distribution to all manufacturers and other large fuel users, accompanied by a letter setting out the terms upon which gas and coke are supplied in large and small quantities, would undoubtedly cause a good deal of inquiry, and should lead to a fair amount of business. In this connection it should not be forgotten by readers that large supplies of the leaflet referred to may be procured, free of charge, upon application to the Parliamentary War Savings Committee, No. 12, Downing Street, S.W.

Formation of Coke Committees.

Much good work could be done in the direction of pushing coke for steam-raising purposes if the undertakings in the large Provincial districts could be induced to follow the lead set them by the Metropolitan and Suburban gas companies, who, early in the day, formed the London Coke Committee, with a view to taking steps to keep the question of coke well to the fore. Not the least of its achievements has been the appointment of an expert (Mr. E. W. L. Nicol), whose business it is to approach large fuel users in the districts of those undertakings that compose the Committee, and to urge them to give a trial to coke for various purposes—notably for boilers and steam-waggons. Excellent work has been done, and large numbers of important converts have been made.

It is not, however, satisfactory that London should be the only district in which this important work is being carried out. Why should there not be a Lancashire, a Yorkshire, or a Midland Coke Committee, or a Coke Committee attached to each Gas Association? Many members of these Associations would undoubtedly welcome such a step. It may, of course, be said that the present Commercial Sections render unnecessary the formation of any such Committee; but if so, there is one very important omission, and that is the mission of the "expert," who should be the life and soul of the organization. The ideal Committee should concern itself chiefly, and almost entirely, with the advertisement of coke, its practical trial in works in competition with coal, suitable appliances for its use, and such practical questions as to the correct size for different purposes. The expert and his report should always be the main business at each meeting.

Is it not possible to carry out this suggestion? Whether it is in connection with existing Commercial Sections or newly-formed Coke Committees is not a material point, so long as the expert for each district is duly appointed. With some short-sighted undertakings the question of expense will be an insuperable barrier, though it is probable that a small annual sum invested in this way would reap a rich harvest. But niggardliness has too often been shown to be a factor of importance for it to be overlooked.

The suggestion is therefore made that this difficulty, should it exist, could be overcome by the appointment of an engineer for part time employment only. It is essential that he should be experienced in the working of boilers, and if he should already be engaged in the manufacture and sale of any boiler accessories or fittings, and be therefore acquainted with boiler users, it would be an advantage rather than a detriment.

Better far to have a competent and whole-time engineer, who should find more than enough useful work to keep him fully occupied; but the other suggestion is mentioned in view of sceptical and penny-wise people who will rarely give any scheme more than a half-chance of succeeding.

HIGH POWER OR LARGE GAS-ENGINES.*

Chis is a book on large gas-engines written by H. Dubbel, but ranslated from the German by F. Weinreb (a Manchester conulting engineer), who has edited and expanded the volume, "so s to include British engines and British practice." The purpose f the work was to act as a guide to the theory, principles of peration, design, and generally the more important constructional eatures of large four and two cycle gas-engines. Translation has een undertaken by Mr. Weinreb mainly because—and this sugests the chief value of the volume—of the large number of secional drawings contained in the book; and to these have been sefully added others illustrative of British design. The advent f the large gas-engine is attributed to Continental enterprise, nd its success regarded as the result of a comparatively freer xchange of ideas and designs abroad than at home.

Although full credit may thus be given, it should not be forotten that it was Mr. B. H. Thwaite who in this country first sed blast-furnace gas for internal combustion engines. This ave scope for the large engine which Germany was quick enough o develop and construct, but it is believed was put into practical nd successful use at the John Cockerill Works at Seraing, near iége, Belgium.

Speaking broadly, British engineers, although once deterred by ncertainty as to the future of the large engine, were probably nore influenced by the question of its first cost, and, too, by the eneral possibilities and adaptability of the steam turbine. Judgng, however, by the adoption of large engines in this country and merica, there is now an absence of any feeling as to the uneliability originally due to constructional weakness of important arts, and to difficulties with valves and valve-gears. English ractice has brought about departures from the earlier designs, ith good results in simplification and efficiency; and there are everal firms in this country who are making engines of very high owers. There is probably a great future for this class of engine, articularly in districts where blast-furnace or coke-oven gas is vailable; and it has been said that those of British design are kely to occupy a very prominent position in the field.

Neither the author nor the translator in his additional matter as, however, expressed any opinion as to the scope and possibilies of the purely large engine, and little as to its merits or demerits. o information is given as to the initial cost of plant and foundaions, or the expense of working either with or without reference o competitive forms of power. The money aspect, after all, has very important influence on the development of any apparatus; or prospective economy tends to stimulate ingenuity and improvenent. There are obviously many facts to be considered—the apital necessary for large gas-engines and steam plants respecively, bearing in mind that attempts to cut the price of the former nay seriously reduce its superior fuel economy; charges for inteest, depreciation, repairs, and attendance; and the availability nd cost of fuel. There are figures on record, and therefore could e quoted, which would have been useful in this book. It would eem that there is little to choose between modern steam engines nd turbines on the score of fuel, but very material gain where arge gas-engines are used. But one would like some idea of other nportant costs, such as that of plant.

Apart from these considerations, the author, or authors, have resented a book which, while including theoretical calculations, s also serviceable from a practical point of view, especially as it lustrates so well the design and chief constructional features of he principal large engines. The German makes naturally, from he origin of the book, come in for chief notice. Unfortunately, he treatment of phases of the subject is to some extent disjointed, nd at times not very lucid.

In the first two chapters, the author discusses, theoretically and hortly, the gas-engine cycle, the fuels—furnace gas, coke-oven as, and producer gas—used for driving large engines, and cylinder limensions in relation to output.

After another short chapter (six pages) on hit-and-miss governng, quality or mixture governing, quantity or charge governing, nd combined governing, we come to a more lengthy discussion f four-cycle and two-cycle engines. Yet discussion is scarcely he word. There has been from time to time some controversy s to the comparative merits of these types; and it would have een of service if the author had supplemented, with some exression of opinion, the comparison made on p. 81. He states hat, so far as theoretical thermal efficiency is concerned, there is othing to choose between the two and four cycle methods of vorking, but that in practice the gas consumption per B.H.P. is ighest in the first case, the negative work of which being twice hat of the four-cycle engine. The two-cycle engine is also at a lisadvantage on the score of speed, which has a limit of about oo revolutions a minute. On the other hand, the speed can be nore easily varied. This facility, together with the smaller space equired, favours the two-cycle engine for blowing and pumping urposes. There are other advantages not mentioned—such as eliability, quicker starting power, &c.

Notwithstanding these points, some engineers consider the fourtroke cycle the proper one for gas-engines, as the two-stroke ngine must be accompanied by air and gas compressors. Its reater speed, accuracy of governing, and higher range as to size, re factors in its favour.

The chapter on four-cycle engine valve-gear is interesting, in view of the variety of devices adopted to meet the several conditions of mixture, charge governing, and their combination, and also of the many excellent illustrations included.

In dealing with two-cycle engines, reference is made to the considerable modification of the Körting engine by English makers—work which has taken place with advantage as to simplicity, compactness, and efficiency. To quote the author: "The cam-shaft has been abandoned, the crank-shaft drives the governor directly, and also the inlet valves by an eccentric rod and rolling levers, the back inlet valve being connected by a rod to the front inlet valve." This is an improvement on the original design.

The question of ignition occupies Chapter VII., and low and high tension with their timing devices are described and illustrated. The effect of using several ignition plugs, instead of one plug, is shown by diagram.

The difficulties experienced in making large cylinders to stand expansion strains naturally invests with interest the chapter on cylinders. These pages are probably as good as any in the book, since the author (for once) supplements mere description with some, although not very full, discussion of the points raised. He deals with the methods adopted by different makers to reduce as much as possible casting stresses, and such stresses as are due to differences of temperatures during the running of the engine. The causes and avoidance of cracks by such means as the thickening of the outer jacket compared with that of the inner cylinder, equal distribution of metal, and symmetry of cylinder are treated; but in part the influence of similar factors is only to be appreciated by the student from careful consideration of the various designs included in the chapter. It is, however, now recognized that troubles from cracking and the like have, to all practical purposes, been overcome.

So far as valves are concerned (Chapter IX.), it is pointed out that no special cooling arrangement is required for the inlet valve, since this is effected by the incoming gases, but that the exhaust valve, exposed as it is to the high temperature of the exhaust, is in most cases water-cooled—an English firm being the first to do this. It is remarked, however, that uncooled exhaust has been recently used without any trouble by one German firm. No great stress is laid upon the difficulties experienced with the exhaust valve, although it has been shown that special attention has to be paid to its adequate cooling, accessibility, and facility of renewal.

In connection with the subject of pistons referred to in the next section, the author considers it is best, but he is not very emphatic in the advice, to use stay bolts for strengthening purposes. Although the wisdom of using ribs is questioned by some, he says that many firms do not regard rib-stiffened pistons as bad practice, provided that care is taken to cool the casting. Where failure has taken place, the student is left to infer that it was attributable to a wrong arrangement of ribs. Differences in types of pistons, and methods of fixing and cooling, are shown by illustrations of various makes.

The general design of the principal parts (frames, bearings, crossheads, rods, shafts, &c.) of large engines is dealt with in Chapter XII. in much the same way—that is to say, drawings of manufacturers are reproduced and allowed, with brief accompanying remarks of the author, to tell more or less their own tale. Unfortunately, the method is not instructive, and one has to look elsewhere for information on some points.

Chapter XV. deals in general terms with the piping required for supplies of gas, air, and water, and also for the exhaust. The principal pipes of two blast-furnace gas blowing engines (900 mm. stroke 94 revolutions per minute) are shown; but while the mean air and gas velocities, in cubic feet per second, are stated, the reader looks in vain for any information as to the diameters of the pipes suitable for the work. Methods of reducing the noise and vibration caused by exhaust are indicated.

Some idea regarding the quantity of water required for large gas-engines is obtained by the statement that the consumption is about 4½ to 6 gallons per B.H.P. per hour, allowing for a rise of temperature from 15° to 45° C. This quantity is much more than that required for ordinary gas-engines, and the question of water supply merits attention, particularly as with some engines the water may run up to much greater figures than those given. Any higher temperatures than 45° C. are to be avoided; otherwise scale may involve trouble.

The last chapter includes a very interesting set of diagrams, illustrative of defects caused by ignition and pre-ignition under different circumstances.

The numerous plates and drawings which are appended are well worthy of study. A perusal of the book gives a good idea of the many difficulties met with in the construction and use of large engines, and at the same time of the engineering skill which has been so successfully applied to their removal. The volume is capable of useful textual expansion in view of the value of its illustrations.

The Work of the Institution of Gas Engineers.—In the "JOURNAL" for July 20 last, there appeared an extended notice of Part I. of "Gas Engineering and Gas Manufacture: A Review of the Institution of Gas Engineers." This covered the period from 1863 to 1883. We have now received from Messrs. J. G. Hammond and Co., a copy of Part II., dealing with the years 1884 to 1894. The review is edited by Mr. C.W. Hastings.

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* "High-Power Gas-Engines," by H. Dubbel. London: Constable and Co. Price, 18s. net.

CARE AND MAINTENANCE OF THE "DE BROUWER" RETORT CHARGING AND DISCHARGING PLANT.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

[*Continued from p.* 482.]

De Brouwer Discharging Machine.

The "D. B." pusher or discharging machine, of which a photograph is shown in fig. 5, has, structurally, much in common with the charging machine or projector. But whereas in the latter machine there is no back thrust, in the ram machine the frame of the apparatus has to withstand the entire strain caused by the pushing action of the ram on the caked coke in the retorts.

The portion of the machine containing the actual discharging mechanism is, as in the projector machine, suspended within an outer frame in which it can be raised or lowered to accommodate itself to the particular tier of retorts which have to be pushed out. As in the case of the projector, the outer frame is mounted on four travelling wheels, and is propelled along in front of the retorts by an electric motor mounted on the sill plates and controlled by a tramway type controller fixed on the operator's platform. This motor performs the dual duty of propelling the entire machine and of raising or lowering the inner, or discharging, element; the change from one motion to the other being performed by means of a clutch lever situated at the side of the travelling controller.

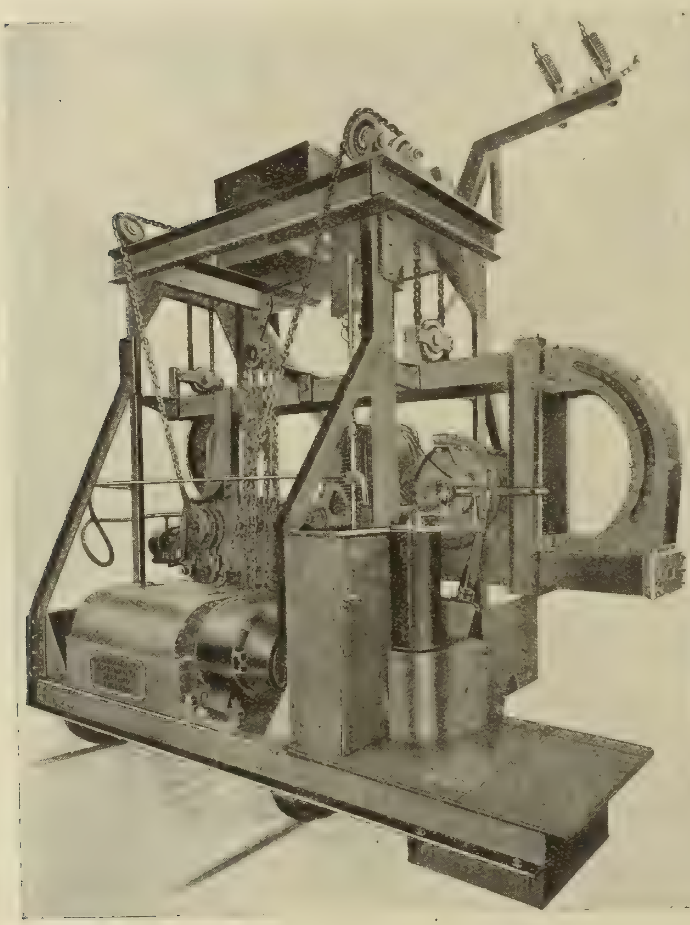

Fig. 5.—The "D.B." Discharging Machine.

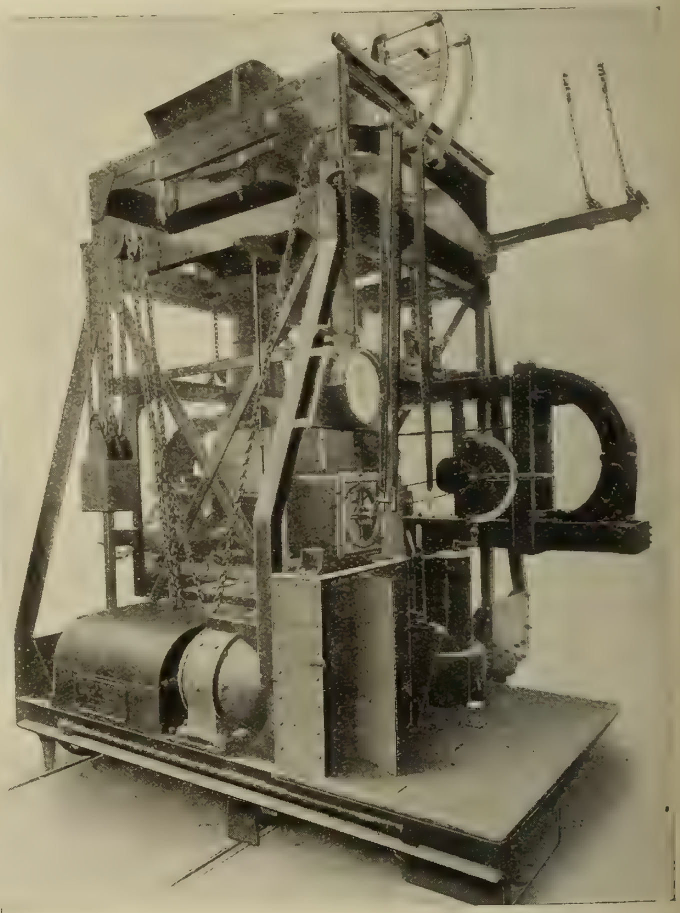

Fig. 6.—The "D.B." Complete Stoker.

The frame, while built on the same lines as that of the lighter projector machine, is much heavier, in order that it may withstand the back thrust alluded to previously; while the motor used for propelling and raising is of 11 B.H.P., running at 350 revolutions per minute.

The ram or pusher element of the machine consists of two or three telescopic lengths, the outer length of which is fitted with a pusher-head. Rack teeth are cut on the underside of these lengths. In order to allow of its being driven through the machine and retort, a number of links, each with similar teeth cast on, are attached to the tail end of the telescopic lengths; thus forming a long rack, which, by the construction of its component parts, is flexible in one direction only. That is to say, on the return stroke of the machine the links will take the semi-circular path offered them by the curved guide-plate at the back of the machine, but on the other stroke the entire element will extend as a solid bar inside the box-shaped guiding lengths.

When erecting, the most convenient way of putting the ram and chain together is as follows: The second and third lengths of the telescopes are placed in position in the hanging frame, the plain links are attached to the rack and put into the second length from the front, while the rest of the chain, ready coupled together, is put in, upside down, on the top return path. The lug link is then brought round to the back guide casting, opposite one of the openings in it, and the rack and plain links pulled in together until the two parts of the chain come together and enable the remaining pin to be put in and riveted up.

The front catch requires very careful adjustment. The cam must be so set as to lower the catch slightly before the respective lengths move forward, and both stops on the cam should be checked to see that they are clear and remain clear until the telescopes have returned to their respective positions. To ensure the catch being properly set, the gear wheels and the differential gear at the front end of the hanging frame are marked, and the wheels should be so set that the teeth so marked are in mesh with one another when the telescope is right back in its position of rest and the catch is in its top position holding back both lengths of telescopes.

It is important that the contact edge of the front catch should be kept square, also the bottom front edges of the channels, as these are liable to become worn, with the result that the catch would not hold the telescopes and they would go forward in the wrong order. To keep the telescopes as cool as possible, the machine is fitted with water-spraying apparatus. A spray pipe fixed over the pusher-head is connected to a small overhead tank, and holes for the reception of the water are provided in the top plates of the telescopes. The flow of water is regulated by a cock which is fitted with a long rod and a handle arranged in a convenient position near the operator.

To obviate the possibility of the ram being over-run on either its outward or return stroke, a safety device is attached to the tramway type controller by means of which the ram motor is regulated. The function of this gear is to automatically stop the motor at the ends of both strokes. It consists of a differential gear driven from the ram motor countershaft by means of a 1-inch pitch Hans Renold chain. In order to start the ram in motion, a hand lever is arranged on the side of this differential gear box and made adjustable to suit the height at which the ram is working by means of three notches, into which it fits with a spring lock, so that when working on the bottom tier of retorts the lever is held in the top notch.

To start the ram on its outward stroke the lever is moved lowly downwards in steps equal to the five notches on the con- roller, and when the ram is about 3 feet from the end of its maxi- num stroke, one of the tappets on the safety gear engages with he lever and commences to bring the controller to its off posi- ion, which position is reached simultaneously (if the tappets are orrectly set) with the end of the stroke. The lever is now free o be moved upwards in steps (as before) for the return stroke; and n the same way the second tappet on the differential gear comes nto operation when the ram is about 3 feet from its "home" osition and commences to bring the controller to its "off" posi- ion. The gear is so proportioned that the outer element makes bout three-quarters of a revolution during the complete stroke f the ram, and is so arranged that, having once come into action, he operator cannot move his controller back to the last position, ut can only reverse.

The ram is operated by a motor of the same type and size as hat used for travelling purposes; the drive being transmitted rom the motor countershaft to the gearing at the front of the am by means of a 2½-inch pitch roller chain.

Electrical Arrangements.

The current collecting arrangements are the same as in the rojector machine; the current being brought to the distributing oint *viâ* a main double pole switch and an automatic circuit reaker. The current for the ram motor is transmitted to the anging frame *viâ* two banjo wires strained vertically on the uter frame, and collected by means of two spring collectors. he two main leads from the distributing point are connected to hese banjo wires. It will be noticed that whereas in the pro- ctor machine three banjo wires are required, only two are used n the ram machine, owing to the motor in the hanging frame eing a compound-wound machine and having no variable shunt heostat.

In the case of the ram machine, both the travelling-hoisting nd the ram motors are interchangeable in all respects. This ractice may, in the case of the heavy complete stoker [of which description is given in a later portion of this article] lead to the m motor being somewhat too large for its work. But it must be membered that these machines usually come in for some very ugh handling; and it is an advantage to have the motors of mple size for their work, as motors liberally rated in this respect e far less liable to give trouble from burn-outs and minor faults. he motors are permanently compounded machines—sufficient unt turns being added to a series type motor to give a fairly gular speed, even under light loads—and are both operated by ntrollers of the tramway type.

The electrical connections of both the motors are as shown in . 4 [*ante*, p. 481]. But, in the case of the ram motor, provision made, as has already been described, for bringing the controller its "off" position automatically with the arrival of the ram at e limits of its stroke; the entire equipment, motor, controller, d resistances, being carried on the hanging frame, on which e ram itself is mounted.

Another automatic electrical device fitted to this machine is r the purpose of preventing overwinding when raising or lower- g the inner frame. It consists of an automatic cut-out switch ed at the back of the controller. The tappet levers operating is switch are adjustable, and care should be taken when setting e gear to ensure that the switch operates when the top and ttom positions of the hanging frame are reached. When this itch operates, needless to say, the controller should be brought its "off" position before closing the tappet switch.

The Complete Stoker.

The complete "D.B." charging-discharging machine is simply a mbination of the projector and ram machines—both the pro- ctor and the ram, with their respective operating machinery, ing fixed on one hanging frame, on which they are levelled-up such a manner as to allow of a retort being first discharged and en filled without any alteration in the vertical adjustment of the ner frame. The general construction of the inner and the outer ame is, of course, heavier than in the case of the single machines. he area covered by the complete stoker is, however, consider- ly less than that taken up by two separate machines; while perience has shown that this combination of two excellent achines has not in any way interfered with the high reputation hich the "D.B." machines have always enjoyed in respect to w maintenance charges.

It has been argued that, in the event of an accident occurring the motor or other part of the mechanism, the entire stoking ant would, in the case of the combined machine, be brought to standstill. This argument will certainly be applicable to a very all extent in the case of a single installation; but it must be membered that the liability of a machine of this (or, indeed, of y) type to a breakdown is largely proportional to its load factor namely, the proportion of its working hours in any given period the total number of hours in that period. It sometimes happens at a machine has, single-handed, to deal with such a number of nches as to necessitate its almost continual operation. This actice leaves a very small margin for the attention that is solutely necessary for the well-being of the plant, and leaves ne at all for the ever-present possibility of breakdown, and n only be characterized as a "penny wise and pound foolish" licy, unfair to the machine, to its makers, and to the share- lders of the undertaking pursuing it. An undertaking which n afford to adopt a machine of this type, and which is of a sufficient size to keep it continually at work, should be certainly able to put down a second machine and to use the two alternately. The extra expense would soon be saved by the reduced repair bill and the freedom from those breakdowns which must occur on any machine which has to undertake such heavy duty continuously.

Returning to the case of an undertaking whose load factor in respect to the stoking machinery is not so high as to warrant the purchase of a second machine, the best insurance against breakdown is the keeping of a reasonable and well-selected stock of "spares," when it will be found that any breakdown that may occur can be speedily put right. The maintenance charges in respect to the combined machine will be found to be very low; and it may safely be asserted that neither the bulk, the weight, nor maintenance difficulties can be advanced as arguments against the complete machine.

Fig. 6 shows a photograph of this machine, from which the general arrangement will be easily followed. The machine is designed for working in conjunction with a set of continuous hoppers having outlets fitted with slides arranged vertically in line with the retorts. The jaws at the back of the chamber form a special device for opening and closing these hoppers. The first part of the movement of the hand lever causes the arms to rise up and grip cleats fixed on the hopper doors, which are then opened upon the further movement of the hand lever. On pushing back the lever the reverse action takes place; the door first being closed and the levers then dropping out of the way to ensure clearance when travelling along the house.

The coal is fed from the hoppers into a specially-designed weighing chamber attached to the machine which automatically weighs the charges placed in the retorts; the weight being indicated on a dial arranged over the speed regulator on the operating platform.

(*To be continued.*)

YORKSHIRE JUNIOR GAS ASSOCIATION.

Annual Meeting and Visit to the Leeds Gas-Works.

The Annual Meeting of the Members of the Yorkshire Junior Gas Association took place last Saturday afternoon, at the Meadow Lane Gas-Works of the Leeds Corporation.

Prior to the meeting, the large party, in a persistent downpour of rain, inspected the works, under the guidance of Mr. W. B. Leech (the Manager and Chief Engineer), Mr. A. Edwards (Chief Chemist), Mr. G. H. Mitchell (Commercial Manager), Mr. H. A. Collett, Mr. C. Dougill, Mr. Walter Hole, and Mr. C. Payne.

The first point of attraction was the gas-furnace show-room, a comparatively new feature of the Leeds undertaking, which has been established to push the superiority of gas-furnaces for metallurgical purposes—in which Leeds industries are greatly concerned—over the coke-furnaces which have been chiefly used in the past. The rooms contained the best makes of furnace, in various designs to suit all purposes; and the great advantages in the way of heat regulation, time and labour saving, and invariable reliability for steel-working were demonstrated. This department of the undertaking, it was stated, has proved an immense success.

The visitors were next shown the equipment for receiving coke-oven gas direct from the Middleton Colliery Company. The gas, it was pointed out, was compressed at the colliery and delivered at the gas-works at Leeds under pressure. In case anything should happen to the outlet of the meter at Meadow Lane, and a stoppage occur, a safety seal has been introduced in the connection outside the meter, and has been so equipped that if the pressure at the Middleton end should temporarily fail, the gas would not be driven in the contrary direction—from Leeds to Middleton. The meter had a capacity of 75,000 cubic feet per hour. At Meadow Lane the coke-oven gas was measured crude. It had not been possible to put down an extra set of purifiers for it; so the Middleton gas was being worked in with the carburetted water gas, in order that any variation in the Middleton gas might be made good by the water gas, over which they had full control. It was found that a very satisfactory mixture resulted.

In the purifiers for the water gas, which the visitors next inspected, it was pointed out that up to now it has been expedient to use lime, which has to be renewed fairly frequently; but endeavours were being made to change over to oxide purification as soon as possible by fitting a Pickering connectionless valve. For checking the delivery of the coke-oven gas there are two Beasley recorders, working side by side—one on the mixed gas and the other on the coke-oven gas. On the water gas alone there is a fairly steady water line; but in the coke-oven gas it could not be quite so steady. In front of the recorders there is a little saturator, in view of the fact that the recording room adjoins the boiler-room; and the saturators thus help to steady the water line.

Continuing the tour, the visitors passed through the carburetted water-gas plant, which is of three units, each of 900,000 cubic feet per twenty-four hours. This is to be remodelled, under the scheme of modernizing the Meadow Lane works, to increase the capacity from 2,700,000 to 4,500,000 cubic feet per twenty-four hours. The engine-room, it was pointed out in passing through, contained two exhausters, each of 80,000 cubic feet per hour capacity, one twin exhausting set removed from the coal-gas plant, of 200,000 cubic feet per hour; two high-speed steam-engines and blast fans, one patent tar-extractor driven by a 20 B.H.P. motor, and circulating water and oil pumps. There were two sets of condensers and washers—two of Clapham's water-cooled condensers, and four scrubbers, 5 ft. 6 in. diameter, by 30 feet high. The washers are fitted with two sprays—one at the top and one at the bottom. When the purchase of coke-oven gas was arranged, it was decided to use the relief holder for any excess that could not be immediately dealt with. After a very little time of working, it was found that the mixed gas was better than the water gas, which suggested that it was being admitted at the wrong place. Now it is admitted at the inlet to the condensers, and they are getting the full benefit of the carrying power of the coke-oven gas. The finish of the purification of the coke-oven gas and the water gas is by two oxide catch boxes, 35 feet by 30 feet by 6 feet deep, with 24-inch connections and Pickering's connectionless valve; the boxes being end to end and having a common division.

In passing to the water-gas meter, of a capacity of 85,000 cubic feet per hour (alongside which three coal-gas station meters are to be erected in a house), and the two gasholders, of 529,000 and 5,163,000 cubic feet capacity respectively, the party were shown a breeze-washing equipment. In the calorimeter house were seen a Beasley recording calorimeter for coal gas, sulphur test, &c. In the governor-house were three station governors; two compressing sets directly driven by gas-engines, 4000 cubic feet per hour each; two compressing sets similarly driven, of 20,000 cubic feet each; and one pressure-raising fan (Rateau) driven by a 4 B.H.P. motor, and capable of passing 150,000 cubic feet per hour against a 3-inch pressure difference. Each of these governors supplies practically a separate district. The conductors showed the installation of automatic pressure-wave controllers, in connection with the lighting and extinction of street-lamps, which have recently been adopted in the city. The great charm of the Rateau fan, it was stated, was that it was absolutely "fool proof."

The party moved forward to the tar-extractors—two Pelouze and Audouin extractors, of a capacity of 4 million cubic feet per twenty-four hours each. The tar passes through a set of atmospheric coolers, two loops of which, as an experiment, have been swathed in canvas, on which water is dropped in the summer time in the hope of reducing the temperature below air level. They have found this successful even in a very dry period.

In the exhauster-house there were two twin exhausting sets, each of a capacity of 200,000 cubic feet per hour; and the bed had been laid for a new Bryan Donkin turbo exhauster about to be erected of a capacity of 200,000 cubic feet per hour, with steam turbine, directly coupled. Particular interest was evinced in the waggon discharge by hydraulic capstan tipper which oscillated to suit the tip of the waggon when raised.

In the meter-house were seen two station meters of 110,000 and 70,000 cubic feet capacity per hour, which, when the new meter-house has been erected, would be transferred, and the site occupied by condensers for the new carbonizing plant.

The visitors passed through the inclined retort-house, containing beds erected in 1896. In the coke yard the telpher conveyor (Strachan and Henshaw's monorail type) was shown. This plant handles coke from both the inclined and the vertical retorts in another house. The coke screening and grading plant in the yard was also shown, by which the coke is fed into 100-ton storage bunkers by telphers and screened by Zimmer jigging screens into carts. The breeze separated is deposited by a rubber belt conveyor in an elevator which feeds it into an Allison grader, of a capacity of 10 tons per hour, the breeze being graded into three sizes—dust, smithy breeze, and walnut coke. The screens and grader are driven by 12 B.H.P. and 8 B.H.P. motors respectively. There the visitors were shown four benches of horizontal retorts, of a total capacity of 2,000,000 cubic feet per day, which are to be pulled down and the house converted into a coal-store. The last point of interest was the vertical retort-house, where there are two benches of intermittent retorts, each containing five beds of 18 retorts, 4 metres (13 ft. 1½ in.) long; the total capacity being 2,300,000 cubic feet per day. No. 1 bench, it was stated, has been working since December, 1913, and No. 2 is in course of erection. There are twelve-hour charges of 9 cwt. each, and steaming goes on for the last two hours. There are step-grate furnaces, hydraulic capstan and waggon tipper, coal receiving bunker, elevator, and conveyor, driven by two 12 B.H.P. and one 8 B.H.P. motors, hydraulic coke-hoists, a hot-coke conveyor of the De Brouwer type, driven by a 12 B.H.P. motor, underground filtration tank for saving and re-using quenching water, the latter of which is now being built, and by which the filtered water will be raised to the overhead supply tank by a Rees Roturbo centrifugal pump directly driven by a 5 B.H.P. motor. The vertical retorts at present in use are producing about 13,500 cubic feet per ton of coal, and during the test period have, as a matter of fact, produced more than this. The No. 2 bench, in course of construction, proved of interest, by reason of the practical illustration of the structural features of the new retorts.

Annual Meeting.

The inspection ended, the annual meeting of the Association was held in the mess-room at the works; the retiring President (Mr. J. W. LEE, of Chesterfield) occupying the chair.

The PRESIDENT reported that 17 members of the Association were now serving with the Colours, and a large number in addition (several of whom, it may be mentioned, were present) had enrolled under the Lord Derby scheme, and were wearing the khaki armlet of the Army Reserve. The names of those actually serving were: Messrs. A. S. Balmforth, G. C. Bradbury, E. H. Bradbury, H. E. Bramer, J. A. Butterfield, C. D. Birks, G. Holdroyd, C. R. Ingham, J. Kennington, H. R. Lawton, J. Park, H. Pickles, C. Ratcliffe, R. Sutton, H. Townsend, H. Rayner, and H. E. Wilby. For some little time there had been thoughts in the mind of some members of the Association as to whether or not, in view of the heavy calls at present upon the time and energies of gas engineers, the Association should continue to hold any meetings. He thought he could safely say that most, if not all, of them had come to the conclusion that, so long as the meetings did not reduce their efficiency as workers for the country in the crisis through which it was passing, there was no possible reason why the meetings should be discontinued. They would, he thought, agree that, instead of the meetings tending to reduce efficiency, they undoubtedly increased it to a considerable extent. There had always been need for men engaged in a profession to meet and exchange views and experiences; but now, when the gas industry had been called to such unusually important work in the defence of the nation and the allied countries, the need was greater than ever before. The session just closing, during which he had been the President of the Association, had been one which had not called for a very great number of meetings. The beginning of the new duties to which they had had to get accustomed, and the reduction of railway facilities, had, naturally, had an effect against bringing members from all parts of the country together, and so had tended towards a reduced programme. Something of the same conditions would, he supposed, prevail in the coming session; but the Council had already got to work in preparing an attractive programme. The new President would give his Inaugural Address in January; for February they had invitations to visit more than one works; in March they were to have a paper entitled "Fuel Economy;" and a visit to a tar-extraction works was in view for April. His duties in the chair came to an end that day. All he had been able to do during his year of office had been a pleasure, even though it had meant, in his own case, rather more long-distance travelling than was usual for a President. He was quite sure that Mr. Demain, the new President whom they had in view, would come to the work with the keenness which had characterized the Past-Presidents. In the name of the members, he extended a hearty welcome to Mr. Demain. He (Mr. Lee) could only hope that when Mr. Demain retired he would be able to do so in a time when the conditions of the industry and of the country were very different from those of to-day.

THE NEW PRESIDENT.

Mr. J. DEMAIN (of Garforth) then took the chair. Having briefly expressed his appreciation of the honour done him by appointing him as President, he said he knew that in gas-works, tar-works, and coke-oven works they were all very heavily engaged now; but he hoped they would do their best to keep the Association active, despite the difficulties of the time. They must not think, if a monthly meeting happened to be missed, that something was going wrong in the Association. He had great pleasure in moving a hearty vote of thanks to the retiring President for his services and his big sacrifices during the past year.

The motion was seconded by Mr. P. M'NAB (Hon. Treasurer), and carried unanimously.

On the motion of Mr. LEE, a hearty vote of thanks was accorded the other retiring officers.

ELECTION OF OFFICE-BEARERS.

The declaration of the vote for new officers was as follows:

Vice-Presidents.—Messrs. J. B. Balmforth and J. A. L. Cooper.
Hon. Treasurer.—Mr. P. M'Nab.
Hon. Secretary.—Mr. Ed. Garsed.
Assistant Hon. Secretary.—Mr. F. Peel.
Members of Council.—Messrs. J. W. Lee, W. Walker Atley, A. Edwards, S. C. Roper, F. Schofield, and E. J. Sutcliffe.
Hon. Auditors.—Messrs. A. Lister and G. E. Walker.

THE SOCIAL SIDE.

The party then adjourned to the King Edward Restaurant, where, as guests of the Leeds Gas Committee, they enjoyed a substantial repast, in the course of which the thanks of the Association were accorded Mr. Leech and his Committee and officials.

Board of Trade and Coal Supplies.—The Board of Trade call attention to the probability that, owing to the increasing consumption of coal in industrial areas and the reduced output from mines due to the enlistment of miners, it will become necessary for many industrial consumers to draw their supplies to some extent from districts other than those on which they have been accustomed to rely. In order to maintain a regular and uninterrupted flow of coal, it is recommended that industrial consumers should, whenever possible, contract for their requirements, and not trust to the open market. Colliery owners on their part will, it is hoped, assist by making contracts for as much of their output as they can feel reasonably sure of maintaining. In view of the situation, it may be necessary for the Coal Exports Committee from time to time further to restrict the recommendation of licences in the case of coals which are in general demand for home consumption.

DEVELOPMENT OF THE BYE-PRODUCT AND COKING INDUSTRY OF GREAT BRITAIN.

In the report of the proceedings at the first general meeting f the Coke Oven Managers' Association, which appeared in the Journal" for Nov. 16 [p. 369], an epitome was given of the naugural address of the President (Mr. George Chrisp). The ull text of the address is now available; and in view of the nterest attaching thereto, we give it *in extenso*.

Early History of Bye-Product Coking.

The early history of the bye-product coking industry is a story f absorbing interest, recording, as it does, tremendous efforts of he pioneers in overcoming difficulties, breaking down prejudice, onverting indifference, and acquiring knowledge from the hard chool of experience.

Actually, of course, the first bye-product oven was the beehive; ts bye-product being waste heat, utilized for steam raising. As coke-producing medium, the beehive oven for the bulk of British oals still stands supreme; for we must admit that while the etort-oven with modern plant attached can produce satisfactory oke from coal which the beehive cannot utilize, it is rarely able o improve on what its old rival can do, so far as quality is conerned, with a coal suited to its methods of carbonization. The ld system is, however, so wasteful that it is gradually being disontinued; but it is dying hard, after nearly 300 years of vigorous ife.

We learn that the first British patent for extracting tar, ammonia, and the like from coal was granted to Sir Archibald Cochrane (Count Dundonald) in 1781; but little use appears to have been made of it. We are often accused of being far behind Continental nations in this industry; and though not admitting ltogether the justice of the accusation, early development was ertainly tardy. The chief reason was perhaps the abundance of material of super-excellent coking qualities in the coal measures f this country. Coke could be, and was, produced by primitive methods which for metallurgical purposes was ideal, and the originators of the bye-product ovens had the greatest difficulty in rousing the interest even of coke producers.

On the Continent (chiefly in France and Belgium) many of the oals possess in scanty proportions the fusible elements essential o coking; and other means than the beehives were necessary, as the hydrogenous matters were expelled by the slow combusion before structural decomposition of the coal had taken place. Hence the advent of the retort-oven, from which the coked mass ould be rapidly expelled, the coke quenched outside, and a fresh charge of coal inserted. The heat of the walls was thereby reained to obtain rapid carbonization.

A French engineer, named Clovis Knab, is credited with being he designer of the first retort-oven. He erected a battery, with ecovery of certain bye-products, in the year 1856, in France. Shortly afterwards, in 1861, the late Henry Simon interested himself in the oven, which had heating flues in the bottom only, and n conjunction with F. Carvès, another French engineer, introduced side-heating flues to Knab's oven. Mr. Simon, of course, s well known as having been the founder of one of our leading coke-oven firms, Simon-Carvès, Limited, of Manchester.

It was not until 1869 that the first plant appeared in this country. The difficulties met with at the outset seem to have been enormous; and generous tribute is due to the memory of men such as Henry Simon, Angus Smith, A. M. Chambers, Colonel (afterwards Sir S. A.) Sadler, Sir B. Samuelson, and others, who worked so strenuously to further the interests of the ndustry.

Ironmasters looked with suspicion on the coke obtained; comparing it unfavourably with the beehive product in mechanical condition and appearance. Some even asserted that its utility must be seriously impaired by reason of bye-products being obained. Indeed, the structural defects were real, as, owing to the uneven temperatures obtained, and the strong suction kept in the ovens in those days, the coke produced was often spongy and soft. By reason of external quenching, its appearance was also against t. Trouble was experienced with the refractory materials used n construction. Some of these were unable to stand the high emperature and strains developed. Others expanded so much hat wall collapse was frequent. But experience proved a sound eacher, and defects of construction and manipulation were gradually rectified. The chemist proved that the calorific power of the patent coke was equal to that of its elder brother, in spite of its dark complexion and unbecoming appearance. Markets were ound for the hitherto almost unsaleable bye-products; and as prices were rising in consequence, the coke makers began to see possibilities, and the industry was established.

Beehive Plant v. Retort-Oven.

The owners of beehive plants were apparently alarmed at the progress recorded, and praiseworthy efforts were made to adapt existing sets to the developing conditions. As early as 1861 Jones and Blackwell attempted the recovery of bye-products from beehives, but without much success. In 1873 and 1879, a Scottish engineer, Aitken, achieved better results, by introducing a series of perforated conduits in the floor of his oven, through which the products of combustion were drawn, condensed, and scrubbed; the return gas being delivered inside the oven and there burned above the coking material. In England, in the year 1883, Jameson adopted similar methods very successfully.

The retort-oven continued to gain favour; and the introduction of the deferred payment system, whereby colliery proprietors were able to have plants erected at little risk or cost to themselves, undoubtedly accelerated progress. Indeed, the astute business methods of most erecting contractors, though frequently depreciated, had much to recommend them. The fact also that a higher yield of coke was obtained in the retort-oven assisted to arouse interest, promote inquiry, and, in some instances, cause astonishment, as it was argued that by the extraction of the bye-products the weight of coke must suffer.

One point made by the supporters of the beehive, and unfortunately incontrovertible, was that in treating the same coal the old system would produce coke containing less ash than the new. Even to-day one is occasionally told that dirt is "boiled out" in the beehive oven, and possibly actually shown a layer of ash lying on top of a coked charge as indisputable proof. The explanation (not always accepted) is that the ash observed is the residue of the coke destroyed by this method, and that the low percentage of ash actually in the coke is due to deposition of carbon from the volatile hydrocarbons decomposed in passing through the crust of coke which forms on the outer surface early in the coking period. The amount of pure carbon so retained is considerable, and has the effect of materially reducing the percentage of ash in the bulk. This deposit is obtained in lesser degree in the retort-oven, and is described as fur, feather, or hair, in different localities. Here may be noted a coking principle in which the retort and beehive ovens are at variance. A high temperature in the top portion of the retort would undoubtedly give a greater yield of coke, for the foregoing reason, but with disastrous results to bye-products.

Before proceeding further, it should be observed that modern and economic methods of coal washing have greatly influenced the progress of the coking industry; but this subject cannot be considered here.

The Simon-Carvès Oven.

The Simon-Carvès oven was undoubtedly first in the field in this country; and its general principles may be observed in other and later types—considerably modified, however. Much costly, but useful, experimental work was done by the builders of this oven in regulating the dimensions to suit the coking qualities of different coals; and the axiom laid down, as a result of such experiments, was that the lower the coking power of the coal, the narrower the oven had to be.

In 1883, Mr. Simon introduced his recuperator—really a mild continuous regenerator—by means of which the air required for combustion was heated to about 500° C., "by causing it to flow around or about flues containing hot gases from heating flues of ovens." Combustion was effected in the sole flues, and the hot gases were then conducted to the upper portion of the side walls, and along horizontal flues with outlets to flues below, which communicated with the recuperator, after passing through which the gases were utilized for steam raising. This type, and modified forms of it, was generally adopted for nearly twenty years.

Regenerative Ovens.

The vertical-flued regenerative oven, often called the German oven—although, as a matter of fact, Coppée appears to have been the originator of the vertical-flued oven, having erected batteries of these in Belgium in 1861, and introduced them here in 1873—then began to arouse attention. The Otto Company was formed in 1900; and their first plant was erected at Newport (Middlesbrough). The chief feature of their oven is that it is bottom-fired by the combustion of gas in a number of bunsen burners placed accessibly under the oven and distributed evenly, so as to ensure uniform heating and efficient utilization of radiated heat by the air required. This system met with such success that many other companies adopted similar methods; and the reversing regenerative oven is in general use to-day.

The recuperative power of the regenerative oven is a strong point in its favour, as heats can usually be brought back to normal after a stoppage much more quickly than is the case with the non-regenerative type. It is, however, a matter of doubt whether the advantages of the latter type outweigh its disadvantages. The writer wishes it to be understood that any criticism which follows is not directed at one particular system. But having, during the last ten years, had opportunities of observing the results from a battery of regenerative and another of non-regenerative ovens using the same class of coal, and subject to similar conditions, he may be allowed to state his opinion.

The horizontal-flued oven, usually constructed with a partition wall, is for that reason much stronger, as the heavy superstructure of the ascension pipes, valves, and mains receives adequate support; whereas the vertical-flued oven wall must necessarily be subject to crushing strain detrimental to its shape, and tending to shorten its life. The partition wall, of course, reduces the thermal efficiency of the horizontal oven, but permits of any one oven being repaired without undue interference with adjacent ovens. The whole of the flues are capable of inspection, and adjustments in the gas regulation are possible at any point. With many vertical-flued ovens this is not possible, and is a serious drawback.

It is claimed for the reversing regenerative oven that greater uniformity of heating can be secured. But if regenerated air is of any service at all, and as the temperature of the air by reason of the reversing principle must at one period be greater than at another, it follows that variation in flame temperature occurs, with inevitable detrimental effect. Further, the effect of the changing-over is similar, as, the oven being alternately heated by flame and waste heat, there is periodic alternation of temperature; the heat of burned products of combustion being less than that of combustion. In the latest ovens of the Semet-Solvay type this latter objection is removed by the system of continuous regeneration.

A novel method of heating has been recently introduced by the Simplex Coke-Oven Company, which may be styled fractional combustion, and in which the whole of the air is admitted at one point and the gas joins at several, keeping up combustion. Also, in this case, the gas is fed from the top.

Another development of recent date is the coke-oven heated by blast-furnace or producer gas; the products of such distillation being utilized for power or lighting purposes, after extraction of the bye-products.

The introduction of the double main system, by means of which the rich gases evolved at certain periods are kept apart from the poorer gases and reserved for lighting, &c., must also be noted.

The progress of the coking industry, although tardy at first, has, therefore, been considerably accelerated in recent years, and with the growth of our metallurgical requirements in coke, and more especially the exhaustion of our best coking coalfields, must be continued, and further experimental work undertaken with a view to utilizing indifferent coking quality coal in order to meet such requirements.

Compressing Machinery.

One such experiment, the compressing machine—the introduction of which to this country is claimed by Mr. J. H. Darby, of the Coke-Oven Construction Company, in 1902[*]—has been an unqualified success, both as regards coking poor coal and reducing labour, as well as improving generally the coke produced. The desirability of coking compressed coal had long been felt, as it was noticed that the coke produced at the bottom of a charge was superior to the remainder; and this was attributed to the natural compression of the weight of the charge. Stamping by hand and the application of weights were the means first used, and, while certainly crude, they served to demonstrate that an improved cellular structure could be obtained, and a coke produced better able to stand the enormous crushing weight of a blast-furnace charge, yet sufficiently porous to accept the blast.

With the advent of the compressor of to-day, a 40 to 50 per cent. increased oven charge became possible, though later practice reduces this to about 25 per cent., as more taper and clearance are usually allowed for. The coking period is certainly increased; but the yields per oven of compressed charges still show an advantage over uncompressed. The increase in the weight of coke varies from 8 to 20 per cent., according to the locality whence the coal is derived; the increase being especially notable in Durham coals. Further advantages are: Lower production of breeze, the reduction of labour cost, higher yield of bye-products, and less inconvenience to the inhabitants of the surrounding districts.

Coke Handling and Quenching.

Marked improvements have also been made in the handling of the coke. The quencher bearing Mr. Darby's name did much to improve the colour of the coke; while various mechanical loaders are now on the market, most notable perhaps of which is the Goodall machine.

We thus see how the results desired by the introducers of the present coking methods have been achieved. Their objects were, briefly: (1) Production of good metallurgical coke; (2) utilization of inferior coal; (3) higher yield of coke; (4) economy of labour; (5) bye-products. We will now consider the latter.

Bye-Products Recovery.

At first, and for many years afterwards, the ordinary gas-works practice of ascension pipes and collecting or hydraulic main, with sealed dip-pipes, was followed. Owing to the heavy nature of the tar produced, these methods were decidedly troublesome to operate; and frequently as many as four, or even six, men were necessary to keep the main clear. Water or else weak ammoniacal liquor was circulated through the main until the experiment of substituting thin tar was tried. This experiment (usually credited to Colonel Sadler) was a great success, and, in conjunction with the disuse of the hydraulic-main dip-pipes—at that time considered a very daring departure—removed a fruitful source of worry and expense. The tar obtained was seldom, if ever, treated on the plant producing it prior to about 1900; but in recent years the advance in the value of tar products has been such that probably 50 per cent. of modern coke plants are equipped with tar-distilling installations.

With regard to the staple bye-product—ammonium sulphate—many changes in recovery methods may be noted. The "indirect" or "cold" process was until a comparatively recent date the general practice. The products of distillation being cooled, tar and a large percentage of the ammonia present are recovered and separated by decantation. The gases are then scrubbed by the virgin liquor so decanted and afterwards by water. A final washing by weak sulphuric acid is sometimes given, after the gases have passed benzol scrubbers. The ammonia liquor so produced was formerly treated by the intermittent process; large tanks, constructed like egg-ended boilers, being filled with a mixture of the gas liquor and lime water and subjected to heat, usually dry. The distillate was received in a sulphuric bath very similar to present practice.

The next stage was the use of smaller boilers working in series; and the introduction of the continuous stills of Gruneberg, Feldman, and Mallet formed really a natural development of this method. The salt produced by these means could not always be truthfully described as "good grey." But gradually matters were improved; dephlegmators were introduced, attention was paid to the general distribution of the ammonia gas in the saturators, and the evacuation of the foul gases, &c., until discolored sulphate became almost rare. The modern stills of Wilton, Walker, Spence, and others are capable of efficiently treating large quantities of liquor per day and producing first-quality sulphate. The types of saturators used during this period of development have not varied much—indeed, the old "hand fishing" pattern is in constant use to-day, and still finds admirers. The injector type of Wilton is largely used, as is also Walker's bottom discharge.

Direct Recovery Process.

Something of an innovation in the way of ammonia recovery as applied to coke-oven practice is the production of ammonia hydrate from gas liquor. This has been very successful, and if more generally adopted would certainly assist to keep up the price of sulphate. The most notable change, however, in the method of producing ammonia salt is the introduction of the hot or direct process. The idea of recovering ammonia from coal gas without the use of scrubbers was conceived many years ago; and as early as 1882 we find Bolton and Wanklyn taking out a patent for recovering ammonia direct from coke-oven and blast-furnace gases. Their process, briefly, was to admit superheated steam to the gases and cause the mixture to impinge on wire netting or perforated plates, so as to remove the tar and soot, and afterwards pass through perforated trays containing superphosphate, gypsum, or coke moistened with sulphuric acid.

If the gases were rich in ammonia, they were first passed over shallow pans containing sulphuric acid. Two years later, A. P. Price patented similar means, using as absorbent either H_2SO_4, H_2SO_3, or phosphates of soda, potash, and ammonia. Little interest in these methods seems to have been evinced, however, in spite of serious trouble arising with Rivers Board inspectors, by reason of noxious effluents evacuated into streams; and it was not until the introduction of the Koppers "semi-direct" process that attention was given to possible development in this direction. This process came in for somewhat severe criticism, notwithstanding which it has achieved considerable success. Although the deservedly popular direct processes differ from the semi-indirect in many essentials, yet the general principle is the same in each. Objections to the new process were made, to the effect that sulphate of good colour could not be obtained, and that benzol extraction would be difficult or impossible. The improvement in tar-extractors, however, has been such that tar fog can be completely eliminated, and so prevent discoloration of salt; while benzol recovery has been only slightly, if at all, impaired. The advantages possessed by the direct process are many, chief of which is the reduced cost of plant; while the saving of steam for evaporative or power purposes and the reduction or absence of effluent are both worthy of serious consideration.

The development of ammonia recovery does not end here, as only last year a patent was granted to Mr. J. M'Kenzie, of Middlesbrough, for a process for the manufacture of sulphate of ammonia direct from the sulphur and ammonia compounds contained in gases generated by the distillation of coal. It is well known that coal gas usually contains enough sulphur to combine with the ammonia present to form ammonium sulphate; and several methods have been suggested to obtain the synthetic action necessary, using heated oxide of iron as the catalytic agent. Mr. M'Kenzie proposes to use oxides of nitrogen to oxidize the sulphur compounds in the gas to sulphur trioxide. This, with the moisture in the gas (artificially produced, if necessary), forms sulphuric acid. The latter reacts with the ammonia to form $(NH_4)_2SO_4$. As the nitrogen compounds must be present in excess, the gases, after the ammonia reaction, are passed through 144° Twaddel acid, for their recovery. So far as the writer knows, the process is still in the experimental stage; but more no doubt will be heard of it shortly.

The almost universal use of hydro-extractors, or wizzers, for sulphate has had a beneficial effect on the market, as the produce can now be shipped to any part of the world, and there delivered without "bag rot" developing.

Benzol Recovery.

The recovery of crude benzol—a product the constituents of which are playing so mighty a part in the struggle to-day, and of such vital importance, not only to our great Empire but to civilization, that every extra gallon produced is a worthy achievement—has changed but little since its inception. Attempts have been made to freeze benzol out of coal gas; but the cost was found to be prohibitive, and the generally adopted method is absorption by creosote oil. The old intermittent system of distillation of the benzolized oil in pot stills (obtaining 30 per cent. benzol, which was subjected to a second distillation to reach the saleable 65 per cent.) was not altogether satisfactory. It not infrequently happened that delays in the first distillation occurred, with the result at the oil in circulation became so rich in benzol that no more ould be taken up, and heavy losses ensued.

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[*] The Simon-Carvès Company claim priority in this direction, having erected a compressing machine for the New Monckton Collieries in 1900.

The introduction, some twelve or fourteen years ago, of the ntinuous system, by means of which 65 per cent. benzol is tained direct, was of great practical value, as the constant flow debenzolized oil to the scrubbers prevents saturation, and so inimizes loss. Various improvements have been effected in con- nsing and cooling arrangements by heat exchangers and the e, and to-day yields of benzol per ton of coal are much higher an formerly.

Modern coking plants are being equipped with rectification in- allations, and although at present few in number this side of the isiness will develop. One of the earliest rectification plants tached to coke plants was at Malton Colliery, Durham.

Since the introduction of the long ascension pipe and dry main, e amount of ammonium chloride in the soft pitch deposited ere has been such as to command attention; and on many ants it is recovered by the simple process of digesting the pitch d concentrating the liquor obtained. For the latter purpose, e Kestner climbing film evaporator has been used; but the dinary dry steam coil is still the favourite medium, and a good leable product is obtained by this means.

The Past and Present Coking Official.

The development of the coking industry during the last thirty ears has thus been very remarkable, and the evolution of the ant manager not less so. The coking officials of thirty years o who could do more than merely write their names were excep- ons rather than the rule. To-day the positions are occupied by en who have, by energy and intelligence, adapted themselves to anging and progressive conditions, and acquired such chemical d engineering knowledge and skill that they have earned the ght to demand for their Association a place with the other ientific institutions of this country.

HAWKHURST GAS-WORKS RECONSTRUCTION.

In the early part of 1913, the Directors of the Hawkhurst (Kent) as Company, finding that the plant at their works had become tally inadequate for dealing with the increasing demand, con- lted Mr. Andrew Dougall, of Tunbridge Wells, who advised the construction of the works on modern lines. A scheme was epared, and work on it was begun in March, 1914; Mr. Alec E. hitcher being appointed Engineer, Manager, and Secretary to perintend the erection of the plant. In a communication which published in the November "Transactions of the Society of ngineers," Mr. Whitcher describes some of his none too pleasant periences when running the obsolete plant during the early inter, while supervising the erection of the new works.

The old plant had more than fulfilled its duty [the Company as formed as far back as 1868], and was practically beyond mporary repairs, but, of course, had to be kept going at any st. What Mr. Whitcher says of his experiences during this eriod is quite sufficient to show that he was kept amply occupied. ith regard to the retorts, these should have been renewed at ast eighteen months before; and though every means of assist- g the heats were adopted, these were of no avail. Stringent easures had therefore to be taken to maintain any supply at all; d in several cases of emergency he fitted on the foul main a inch iron cock, which was opened for about an hour after a arge, the exhauster thus drawing in a small percentage of air ith the gas. While this was on, the jet photometer had to be osely watched; and it was found that the illuminating power of e gas was not reduced to any considerable extent. The average as 15 candles; and the yield per ton of coal was increased from out 10,000 cubic feet to 11,000 and 11,500 cubic feet, accord- g to the urgency of the demand. The coal used at this time as Holmside, with a small admixture of cannel. This method sisted the purifiers, but could be adopted only in cases of emer- ncy, as it would have been risky to have left its management to stoker.

Coming to the brighter side of things, Mr. Whitcher says that e scheme provided for wholly new plant, with the exception of e station-meter and gasholders. It was so arranged that the hole of the 8-inch connections were separate from, and indepen- ent of, the old works. By means of bye-passing the old-plant pply at the station-meter direct into the inlet main to the olders, and coupling-up the new plant into the station-meter, both anufacturing plants were enabled to work into the holder at the me time. To ascertain whether the air had been expelled from e new plant, a blow-off tapping was made on the end of the new ain before entering the meter. This consisted of a 1-inch main ck, to which was connected, at intervals, a length of pipe reduced take a flat-flame burner—thus showing when all air had been scharged. The old plant was at the same time supplying rich as; and as the new portion came fully into action, the old was radually shut-down. The change-over took place without any itch or deterioration in the quality of the gas supplied.

The new site (which gives plenty of room for future extensions) djoins the old works. The subsoil is sandy, showing traces of ay, with a lower stratum of sandstone; and the foundations onsist of a layer of concrete averaging 2 ft. 9 in. in thickness, nd extending beyond the main walls from 6 to 9 inches. There are three courses of brick footings, of an average thickness of 2 ft. 6 in.

The retort-house provides for four settings of six retorts, and three of the arches have already been constructed. The depth of the furnace-floor below the charging floor is 7 feet. The mouthpieces are all self-sealing; and the ascension-pipes, bends, arches, and dip-pipes are 6 inches diameter. The foul-main is 8 inches diameter, and has one valve for each bed. Tar-pipes are fitted to the underside of each hydraulic pipe, leading to a Dillamore tar-tower. The settings are of the Gibbons regenerative type, and at present a bed of sixes is at work, and giving satisfactory results; there having been no trouble with stopped ascension-pipes, in spite of the high heats which have been maintained without variation since the setting was started. The average yield has been 13,000 cubic feet per ton of coal; the coal used being South Hetton small and Derbyshire. The fuel consumed averages 28 to 30 per cent.; the make per mouthpiece, 7000 cubic feet, according to the charges.

The coal-store adjoins the retort-house, from which it is divided by a wall, having semi-circular arched doorways. The store is divided into three bays with brick walls on both sides to a distance of 11 feet, making an opening in the centre of the store of 11 ft. 6 in. The ends of the walls have iron channelling to take timber partitions to separate the bays, if desired to keep different qualities of coal separate, and to reduce the danger of spontaneous combustion. The store when filled will contain a stock of coal sufficient for six months at the present rate of consumption. The coal is easily handled by the stokers, as each doorway is opposite a retort-setting.

The engine and exhauster house is built against the west end of the coal-store. The floor is concreted, with blue and red tiles set diagonally, giving a clean appearance; and the pipe-connections to the engines are covered with iron chequer plates to allow of easy access at any time. The new machinery comprises a 3½ H.P. gas-engine, and an exhauster of the rotary type, driven by counter-shafting, capable of passing 3000 cubic feet of gas per hour, supplied by the Bryan Donkin Company. The old gas-engine and exhauster, having been thoroughly overhauled, have been refixed in the new engine-house. Both exhausters are connected to a governor in the centre, which is provided with an automatic bye-pass for use when the governor is not in action.

There is a sulphate of ammonia plant on the direct system, by the Chemical Engineering Company. It comprises a vertical steam-boiler, together with an acid washer, through which the gas passes, containing serrated bars and mother liquor for extracting the ammonia from the gas as it is made. An overflow circulating pan, fed with sulphuric acid from an overhead tank outside, is provided with the washer. The pan has three divisions through which the mother liquor passes; two divisions containing fine cocoanut matting acting as a filter for the heavy tarry matter. The circulation of the liquor through the acid washer is effected by a small air-pump worked by steam. This also carries the liquor from the washer to the final supply-pan, whence it is run into the evaporating pan.

A Wilton still is also worked with this plant; the liquor being supplied from a small overhead tank. The ammoniacal liquor enters the still through a small funnel at the top, and passes through the chambers. The bottom is supplied with both wet and dry steam; and lime water is passed over from a lime sift and agitator, entering the still at the base. The ammonia passes from the still through a water-cooled supply to the acid washer, and thus the fixed ammonia is liberated. The only trouble experienced with the acid washer was when the mother liquor got above 46° Twaddel, when the washer became choked up; and to clear it, Mr. Whitcher drained off the liquor in the washer, and filled it with water. When the plant was first worked, trouble was experienced with discoloration of the salt, on account of tarry oil carried forward; but this was overcome by passing the liquor through a filter of silver sand before it entered the evaporator.

A Wilton's "Reflux" condenser-washer has been erected. This consists of several chambers, with six bubbling trays, each working with a seal not exceeding ½ inch. The hot gases from the hydraulic main enter the washer at the bottom, and pass upwards through all the six trays. The two upper trays are used in this case as a naphthalene washer by filling them with suitable solvent, such as paraffin or oil tar. The middle trays are provided with water cooling pipes. This apparatus is now, it is said, used in most small works on account of its low cost in comparison with condensers and scrubbers, which it equals in efficiency.

The three new purifiers, 9 feet square and 5 feet deep, were supplied by Messrs. Willey and Co. The valves, six in number, are of the Pickering type, placed below the ground floor, and boarded over. The purifiers are of the luteless type, and occupy what was originally the coal-store; the end portion of the house which formerly contained the retort-benches being now used as a turning floor for the oxide. A lifting-carriage runs on rails on top of the boxes, and is fitted with a screw pulley and wheels on either side. The 8-inch governor is of the compensating type, made by Messrs. Parkinson and W. & B. Cowan.

The new plant, when working at its full capacity, will be capable of making 30 million cubic feet of gas per annum, whereas the present make is about 10 millions.

Captain Richard B. G. Glover, who, as already stated in the "JOURNAL," was recently killed in France, left estate of the value of £2166.

SIMPLIFYING ILLUMINATION CALCULATIONS.

By A. S. M'Allister.

[The Presidential Address at the Ninth Annual Convention of the American Illuminating Engineering Society, at Washington.]

As marking the transition of the science and art of illumination from the methods of the physicist to those of the engineer, no one milestone stands out more prominently than that represented by the presidential address of Dr. Clayton H. Sharp in 1907. Following his presentation of certain concepts and terminology in illuminating engineering, not only was there a change in the output rating of lamps from the indefinite and much-abused candle power to the definite and now well-understood lumen, but many improved methods were developed for solving problems in illumination. In many respects the results have been similar to the substitution of the flux method for the isolated unit pole method of solving problems in magnetism.

While from the point of view of physics there are marked differences between the concept of magnetic lines or "tubes" force and that of lines or "cones" of radiant energy, yet in their mathematical treatment the problems relating to the one are quite similar to those relating to the other.

So far as numerical results are concerned, it is absolutely safe to ignore the direction of travel and mode of propagation of the radiant energy from the source of light to the surfaces upon which this energy is absorbed. Of one relation we can be absolutely sure—namely, the total energy absorbed equals the total energy produced. When methods of calculation give results not in conformity with this relation, it is safe to state that the methods are wrong either in principle or in application. Thus for checking results obtained by more laborious methods, the absorption-of-light method is highly advantageous. In many instances—yes, in most cases—it is permissible to abandon the more complicated methods and rely upon the simplest and absolutely correct energy-ratio method, with merely an occasional reference to some more indirect method for determining the space distribution of the illumination where this is of importance.

Looking back over the "Transactions" of the Illuminating Engineering Society since its first meeting in 1906, one cannot but be impressed by the fact that almost all the solutions offered for problems in illumination have been based on the tacit assumption of point-sources rather than surface-sources. Even when dealing with plane-surface sources, the authors have usually treated them as made up of an infinite number of point-sources arranged in one plane, and have based their solutions on the "inverse square" law and other relations developed from the fundamental point-source conception. In order to obtain results consistent with the known facts in this case, it has been necessary to assign to each infinitesimal point-source in the plane certain physical characteristics not possessed by ideal point-sources, such as the ability to produce light in only one hemisphere which is the fundamental attribute of an infinitesimal plane-surface source.

It needs no argument to show that all calculations are immensely simplified by adopting initially the surface-source conception and utilizing at once the well-known relations developed for surface-sources.

Instead of determining the illumination produced by the source on a chosen plane by reference to the "inverse square" law and the integrated "candle power," the identical value can be derived more conveniently by means of the fundamental ratio existing between the "apparent luminous density" of the source and the lumen density on the surface illuminated, which ratio depends solely upon the solid angle subtended by the source when viewed from the chosen plane.

Allow me to call attention at this point to a fact learned by us all in our school days, but mostly forgotten since then—namely, the extreme ease with which solid angular relations can be represented by straight lines and circles in planes. As a result of this fact, simple circle diagrams can be utilized for solving graphically problems in solid angular relations the solutions of which become very complicated when any other method is employed.

Ignoring for the moment the physical interpretation of the change in conception from the "point" to the "surface" source, allow me to mention here the significant fact that the solution of a problem when based on the one conception is identical with that found when the other conception is employed; so that any errors which may be attributed to the one conception must likewise be urged against the other.

When dealing with surface-sources, it is necessary to take into consideration the fact that not all surfaces obey the so-called "cosine law" of emission in accordance with which a surface would appear uniformly bright when viewed from all possible locations. However, it is equally necessary to take into consideration the fact that the candle power from a so-called point-source, or the "apparent candle power per unit area" from a surface-source, is not uniform in all directions in space. The fact of the matter is that all practical sources emit light in such a way as to appear non-uniform in brightness over the surface when viewed from any one locality; and any one point on the surface apparently varies in brightness when viewed from different locations in space. It is impossible so to express the brightness that its value will not be subjected to the changes here referred to.

If the surface were ideally perfect in its emission, its brightness would be everywhere equal and uniform, and its apparent candle power would vary with the cosine of the angle of deviation of the surface from normal to the line of vision—that is, the surface would obey Lambert's "cosine law of emission." A surface which is not ideally perfect in emission can be compared directly with one which follows the cosine law of emission irrespective of the units in which the outputs or appearances are expressed.

For convenience in calculation and purpose of comparison, it is advantageous to express the outputs in terms of the lumens, and the output density in terms of the lumens per unit area. It is equally as convenient and logical to express the appearance in terms of the luminous output density, selecting for the unit the appearance of a surface emitting in accordance with Lambert's cosine law. For this unit of appearance there has happily been suggested the term "lambert," which is applied to the appearance of a surface emitting one lumen per square centimetre in accordance with Lambert's cosine law of distribution, and is equivalent in appearance to that of a perfect matt-surface of 100 per cent. reflecting power illuminated with a density of one lumen per square centimetre.

Although the introduction of the "lambert brightness unit" is of recent date, it is noteworthy that its exact physical definition was accurately presented before this Society eight years ago in the presidential address of Dr. Sharp, who stated therein that "the brightness of a diffusely reflecting or transmitting surface is proportional to the luminous flux which it emits per unit of area."

In view of the fact that the "lambert" unit is based on the surface-source conception, this method of expressing the brightness—that is, the appearance to the eye—seems to me to be fundamentally much more logical than the more common method involving a reference to the point-source conception. It is impossible to derive an expression of brightness which does not in some way—either directly or indirectly—involve the luminous output and the surface area. That is to say, when the expression of brightness includes a reference to the point-source conception, it is evident at once that there have been assigned to each infinitesimal point-source physical characteristics possessed exclusively by a surface-source. Simplicity in both conception and mathematical analysis dictate the reference of all brightness expressions directly rather than indirectly to surface-sources and not to point-sources.

Problems relating to both the output and the appearance of practical lighting sources are greatly simplified when use is made of the real surface-source conception rather than the fictitious point-source conception.

Independent in every respect of the units employed in expressing the output and the appearance of a surface-source, it is essential to recognize the fact that only in the case of emission in accordance with Lambert's cosine law is either the output density or the appearance uniform over the surface. For simplicity in calculation, it is advantageous to assign such values to these variables that the calculations will give results in practical accord with the actual facts. The mean value of the output density can evidently be found by dividing the total output by the total area of the emitting surface. This value is identical with the mean effective value of the "appearance" or "brightness" of the same source.

For all practical purposes the use of the mean effective value (in space) of the brightness introduces errors no greater than those caused by substituting the mean effective value (in time) of an alternating current for its cyclically varying value. That is to say, problems in illumination from surface-sources—and practically all sources are surfaces—are simplified by substituting the mean effective value of the output density and appearance for the actual values with their variations in space, in exactly the same manner and to the same extent as equivalent problems in alternating current phenomena are simplified by substituting the mean effective value of the alternating current for the actual values with their variations in time.

Let us carry the physical analogies somewhat further. The substitution of the lumen conception for the candle power conception has simplified illumination calculations just as the substitution of the magnetic flux conception for the isolated magnetic pole conception has simplified magnetic calculations. Moreover, the use of the surface-source conception rather than the point-source conception permits of the introduction of graphical methods of solving problems in illumination equally as accurate and convenient as the simplified circle diagrams now universally employed in solving problems relating to the general alternating-current transformer.

To persons familiar with the time-honoured laborious calculating methods of the electrophysicist and with the short-cut (but equally accurate) methods of the present-day electrical engineer, no arguments need be presented in favour of the simplified methods of solving problems in illumination other than the analogies just outlined.

The Committee appointed to report on the above address expressed their admiration for the lucid and convincing expression of the views therein contained. It is remarked: The underlying thought in the address is that illumination calculations can be greatly simplified by discarding the usual method of determining the illumination produced by the source on a chosen plane by reference to the "inverse square" law and the integrated "candle ower," and using the fundamental ratio existing between the pparent luminous density" of the source and the lumen density the surface illuminated, which ratio depends solely upon the lid angle subtended by the source when viewed from the chosen ane. The use of the surface-source conception rather than the oint-source conception permits of the introduction of simple aphical methods for solving problems in illumination. The ommittee "concur with the views expressed in the address and elieve that the application of the method therein outlined will sist materially in the simplification of illumination calcula- ons."

PLANNING OF LIGHTING INSTALLATIONS.

In determining the kind of lighting installation to be provided r any purpose, there are three general factors to be taken into onsideration: (1) Physiological and hygienic requirements. The fectiveness of the light provided for producing illumination of a uality that will permit the eye to perform its functions satisfac- orily and without strain or discomfort. (2) Economic require- ents. Avoidance of useless waste of energy in the production the light and its utilization. (3) The effect from an artistic andpoint. With this submission, Mr. R. F. Pierce lately opened n article in the "American Gaslight Journal" on the "Planning Lighting Installations." After devoting some attention to the ad effects on the eye of improper lighting, he says that unfor- unately the requirements of good illumination cannot be stated such precise and measurable terms as to permit of the laying own of hard-and-fast rules which would govern every case. They ay be stated only in general terms.

The first requisite is, Mr. Pierce continues, obviously sufficient ght for the particular purpose, and under the particular condi- ons, for which it is needed. But proper or necessary illumina- on for any one purpose varies with conditions. A certain amount f light on a reading page may be sufficient where the surrounding alls are light, but entirely inadequate where they are dark, ecause the contrast between the bright page and the dark wall objectionable.

The limits of brightness in the field of vision that are comfort- ble, or even tolerable, are a matter of contrast rather than of bsolute values. Without endeavouring to make fine discrimina- ons, we may at least lay down the principle that the tungsten lament, with its 1000-candle power per square inch, and the in- andescent gas-mantle, with 60 to 90 candle power per square inch, re both so far beyond the limit of human endurance as to require ffectual screening before being permitted in the range of vision. n general, it may be said that any installation in which the eye, the ordinary course of observation, may rest upon a bare fila- ent or mantle, is inexcusably bad, beyond the possibility of argu- ent. Nor is the mere enclosing in diffusing glassware evidence at the objectionable brilliancy has been adequately reduced. An xample of this is the electric flaming lamp with diffusing globe, laced 8 or 10 feet above the sidewalk. The brightness of the lobe is about 40-candle power per square inch—one-half that of e gas-mantle. The mere fact that a globe is "diffusing" is of o importance, unless we know whether or not the diffusing does hat is desired of it—that is, it reduces brightness within tolerable mits.

Generally speaking, we may say that light-sources are excellent inverse proportion to their brightness—the brighter they are, e worse they are—assuming, of course, that sufficient light is elivered where it is needed. These two requirements may be et at the same time by the simple expedient of increasing the size f enclosing glassware. In fact, the virtues of the semi-indirect ystem of illumination lie mainly in the securing of low brightness y increasing the size of the enclosing bowl. Similarly, the merits f the indirect system are derived from the diffusing of the light rom a very large surface—the ceiling—instead of a small one. recisely the same results would be obtained by direct light hrough a diffusing artificial skylight; and likewise all the bene- ts of the semi-indirect system would be obtained by increasing he size of direct-lighting glassware to a sufficient extent—for in- tance, by using with the single-mantle small inverted unit an paline globe of (say) 16 inches diameter. In other words, the ndirect and semi-indirect systems are mainly mechanical ex- edients for reducing the brightness of the light-source. The bject of decreasing the brightness of the light-source is to reduce he excessive contrast between the source and other portions of he room. While it is true that a certain amount of contrast is esirable, it is equally true that, with any of the lighting units ow available or likely to be available, there is not even the most emote danger of insufficient contrast being obtained, at least in onnection with any problem within the scope of any one but the pecialist.

A safe practice for the salesman to pursue is to attempt in ll cases to instal the equipment in which the light-source shall ave the least possible brightness, consistent, of course, with ufficient illumination. In other words, the individual globes and hades should be of the largest sizes practicable. It will seldom e possible, with the commercial glassware now on the market, to educe the brightness to the extent really desirable, except by esorting to the semi-indirect system of illumination; and, indeed, t is this fact that is responsible for the great vogue and rapid pread of the indirect and semi-indirect systems—the impossibility of obtaining relief from obnoxious degrees of brightness by using any of the commercial reflectors that are furnished for direct lighting.

Although the light-source may be effectively screened from the eye, it will produce the objectionable feature known as glare from the surface of glazed papers, &c. Such surfaces act as mirrors, by virtue of the regular reflection from the glazed surface; and a blurred, but quite brilliant, image of the light-source appears. The brighter the light-source, the brighter the image will be, and the more obnoxious the resulting glare. It is for this reason that the shading of incandescent gas and electric lamps by open bottom reflectors usually fails to produce satisfactory results in the lighting of offices, &c. The shading of lamps by such reflectors has no influence whatever upon the production of glare from glazed papers and other regularly-reflecting surfaces.

It is the smaller amount of "glare" from the less brilliant gas-mantle that is responsible for the lesser fatigue experienced in reading under a shaded incandescent gas-lamp than under a similarly shaded electric incandescent lamp. This effect is a matter of common experience, and has been quite generally noticed. All sorts of opinions and theories have been advanced in explanation; some enthusiastic adherents of gas lighting even ascribing it to some quality in the light itself. The perfectly obvious explanation does not appear to have received a great deal of attention.

Outside of colour (or quality, very loosely so-called) of the light, the importance of which has not been conclusively demonstrated, the above considerations are all that enter directly into the excellence of a lighting system with reference to ease of vision and the health of the eye. In addition to these, however, another feature, and a very important one from the commercial standpoint, is artistic effect. The average purchaser of lighting appliances is not so much interested in securing facilities for performing a certain kind of eye-labour, as in providing himself with pleasant surroundings; and personal tastes must be met before the physical requirements of illumination may be considered. Not much success will attend the salesman who attempts to sell lighting appliances with a single eye toward simplifying stock records in the storeroom. It is impossible now to discuss æsthetic or artistic considerations at length. It is only necessary to call attention to the importance of these considerations, and emphasize the need for giving them due attention.

Coke-Oven Managers' Association.

The next meeting of the Association will take place in the Applied Science Department, St. George's Square, Sheffield, on Saturday, the 18th inst., when Mr. G. Taylor, of Silverwood, will read a paper on "Benzol." The Secretary (Mr. J. T. Price) states that membership of the Association is increasing rapidly; and it is intended to form local branches or groups, as soon as most of the managers can be enrolled. Each branch will then hold local meetings, and all branches will meet together annually at some selected centre. The first annual dinner will take place in Sheffield on Jan. 15. At a recent Council meeting, it was decided (apart from these engagements) to alter the time of the meetings to the last Saturday in the month.

A Salesman's Handbook.

Great assistance should be derived from the "Salesman's Handbook" which has been prepared (and is now on sale) by the National Commercial Gas Association, of No. 61, Broadway, New York. It is pointed out that the book should really be called a "service," inasmuch as it will extend over a period of five years at least, and furnish a reference and data book kept continuously up to date by the issue of new pages and the revision of old ones. The service consists of a desk file in which are placed pages of the book not in current use; a leather binder in which are kept the pages to which the user most frequently refers; and the book proper which consists now of approximately 600 pages, divided into ten sections dealing with the various branches of gas supply, and giving tables, technical terms, &c. The price for the outfit, $7.50, includes the mailing of all future pages issued within the period named.

The Coal-Tar Dye Industry.—Dr. F. A. Mason contributed to last month's number of "Science Progress" the first part of an article on "The Influence of Research on the Development of the Coal-Tar Dye Industry." An interesting account is given of the origin of the industry in this country, and especially of the parts played by Perkin, Hofmann, and Caro. Dr. Mason makes it clear that the reason why the industry, although it was started, and for a time made considerable and promising progress in this country, subsequently became the monopoly of Germany, was the dearth of British students of organic chemistry. "Both by nature and good fortune," he writes, "England seemed to be destined to be the great coal-tar dye producing country of the world. Great Britain produced more tar than any other country. The first synthetic dye was discovered here; and Professor Hofmann himself, at the Royal College of Chemistry, was the centre of attraction of the industry. But one thing only was lacking—namely, a sufficient scientific education of the general public, such as was already obtaining in Germany, and a sympathetic understanding and appreciation of the methods and objects of research. To this last is to be traced, directly and indirectly, the ultimate collapse of the British dye industry."

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Price of London Pitch.

Sir,—We thank you for your reply to our letter [inserted in your issue of Nov. 23], and shall be under further obligation to you if you will be good enough to publish our criticism thereon.

We have no doubt that the contracts shown to your reporter were *bonâ fide;* but we should have preferred that he had stated the actual dates of same. You speak of transactions indicated in reports of Sept. 6 and Oct. 4, and later refer to sales made during August and September. May we point out that we have dealt with the averages of September and October only; and we fail to see the relevancy of sales made in August. You admit that the price "drooped" in October; but we have searched your weekly records in vain for any admission of a possibly lower price than 26s., even as lately as Nov. 30. Your reports are headed "Current Sales of Gas Products" under a given date, and are understood to refer to the week ended prior to the issue of each "Journal." How can sales made in August and September hold the field till the end of November, when the market has meantime "drooped?" We agree that pitch for home trade can be taken into consideration of material importance, but not unless the pitch is obtained from London supplies. It is not a question of British pitch, but London pitch; and it is known that, compared with export, London consumption is relatively insignificant. We agree that the domicile of a buyer does not matter, provided that he buys on London terms; but we submit that sales to foreign buyers on "delivered terms" cannot be brought to a London price until the transaction has been completed, which may be months afterwards. Had your reporter said that sales to foreign buyers "influenced" the London prices, we should have been prepared to agree with him.

We claim that, on your own showing, the actual prices in London were materially lower than indicated in your reports, and are confident that if the fullest investigation could be made, and the actual prices week by week be taken for the months of September and October, our figures would be approximately correct.

We can, of course, now see that your November reports from the same source are open to the same objections.

Blagden, Waugh, and Co.

4, *Lloyds Avenue, E.C.,*
Dec. 3, 1915.

[Messrs. Blagden, Waugh, and Co., in their former letter, remarked "During the past few months, however, we are sorry to state that the prices of pitch given under the London section are beyond our comprehension," and proceed to doubt in particular the figure of 26s. per ton. Our reporter thereupon verified with rather full information the transactions already indicated in our columns at 26s., which Messrs. Blagden, Waugh, and Co. now admit as accurate by saying they do no doubt the *bona fides* of the contracts in question. Our reporter, while he enjoys our confidence, will continue to give information representative of the market; but it must be clearly understood that neither the views of merchant buyers nor unimportant sales under special conditions, either for export or home trade, necessarily reflect the real value of London pitch. The largest makers, being the most important of sellers, have a natural right to be heard. At the last moment our reporter has been able to verify other sales of London pitch on the 2nd and the 25th of October for export—leaving the sellers an undoubted 26s. net per ton f.o.b. producing works. Our reporter puts the average value of London pitch for the months of September and October at 24s. 6d. per ton, compared with Messrs. Blagden, Waugh, and Co.'s figure of 20s. per ton. Our reporter is assured that even so recently as last week a large London maker sold a considerable quantity of pitch at 20s. per ton net at his works, which throws the gravest doubt on the assertion made last week by Messrs. Blagden, Waugh, and Co. in our columns that "makers in London would still entertain figures last quoted—viz., 17s. to 18s." Readers would expect the above quotation (17s. to 18s.) to refer to London makers generally, whereas it probably referred to an unimportant quantity, *ex* a comparatively small works.—Ed. J.G.L.]

Lighting of Works' Yards.

Sir,—In one of the "Editorial Notes" in your last issue [p. 473], you again refer to the minimum illumination of 0·05 foot-candle for open-yard lighting recommended by the Home Office Committee on Factory Lighting; and you now suggest that, although this might be sufficient for "open spaces," a higher minimum would be preferable for "dangerous parts" of a yard.

Actual measurements in well-lighted yards (of which I have made a good many) do not, however, bear out your contention; and they tend to show that for "dangerous parts"—*e.g.*, where shunting-engines are moving, and rails and points form stumbling blocks—0·05 foot-candle as a minimum is ample, and this figure might well be diminished for more open, and therefore less dangerous, places.

It was in the hope of convincing you and others that an illumination of less than 0·05 foot-candle is in no sense in the danger zone, that I mentioned (in the recent discussion at the Illuminating Engineering Society) the figure of 0·035 foot-candle on the floor of your publishing office. No one could seriously contend that the floor is dangerous to walk about on, or that anyone could possibly stumble over an object on the floor; and I venture to think that in desiring a minimum higher than 0·05 foot-candle, you are labouring under a mistaken idea as to the degree of illumination which this figure represents.

I agree entirely with your differentiation between "open spaces" and "dangerous parts." But I think you will find that the Committee have forestalled you in drawing this distinction; for they make it clear that for open spaces which are not dangerous they would be content with "beacon" lighting, and do not specify a minimum at all.

Arthur Cunnington.

26, *Muncaster Road, Clapham Common, S.W.,*
Dec. 2, 1915.

Enlistment of Gas-Works Employees.

Sir,—With further reference to the question of the enlistment of gas-works employees, a letter (of which a copy is appended) has been received from the Board of Trade.

In the list of occupations which was enclosed with the letter, "Gas-Works Service" is included under List D—"Occupations (Reserved Occupations) of Cardinal Importance for the Maintenance of Some Other Branches of Trade and Industry."

A note applying to "Gas-Works Service" reads as follows: "Public utility services—gas, electric light, and power corporations, water-works, tramways, and canals. Skilled men in these undertakings, if attested and classified in Section B (Army Reserve), will not be called up for actual service with the Colours unless their employer states that their services can be spared."

Walter T. Dunn,
Secretary, Institution of Gas Engineers.

39, *Victoria Street, S.W.,*
Dec. 1, 1915.

[Enclosure.]

Board of Trade (Department of Labour Statistics),
Gwydyr House, Whitehall, S.W.,
Nov. 29, 1915.

Reserved Occupations Committee.

Dear Sir,—With reference to your letter respecting recruiting, I have pleasure in enclosing herewith a list of occupations which, in one way or another, have been reserved from recruiting at present.

Any men belonging to these occupations should be formally attested under Section B (Army Reserve); and they will not be called up as long as they are indispensable in their respective employments.

(Signed) F. H. M'Leod.

Prices of London Creosote.

A question was recently raised by a correspondent as to the prices quoted for creosote in the pages of the "Journal," and possibly some explanation will satisfy others interested in the subject.

It may be pointed out that the quotations given in our columns for London refer to products made in the London district, and not to materials imported from the country. For many years, supplies of country liquid creosote have come to London, and have usually been sold below the London price. The quantities so imported, however, do not influence the London value—being relatively small compared with the vast London production, which latter is almost entirely a salty creosote. For a long time past, creosote salts have been worth more than liquid creosote.

There have been a number of sales of London creosote for local consumption at over 4d. net per gallon; but as buyers purchase in fairly substantial quantities, transactions do not take place with much frequency. Moreover, numerous exports are of less than a million gallons each—a quantity which the correspondent referred to above maintained it was necessary to have for disposal to get 4d. per gallon, and that one should also be able to secure a tank steamer for the conveyance of same to America. We learn there has been little difficulty in obtaining tank steamers for the traffic.

After all, so far as London produced oil is concerned, the question is what is the value actually obtained for the very large quantity turned out by the chief makers here. From indisputable information in our possession, we are able to state that for some months past the average price has never been under 4d. net per gallon, and much has been sold at 4¼d. and over.—Ed. J.G.L.

Dublin Electricity Station Wrecked.—In the early hours of the morning last Saturday week an accident occurred in Dublin in the neighbourhood of Forbes Street and Sir John Rogerson's Quay; one of the sub stations for the Corporation electricity supply being wrecked. The whole of the brickwork of the building was scattered in all directions. Much damage was caused to adjacent premises; and the oil-tanks and switches were enveloped in flame. It was at first thought that the occurrence might have been due to an accumulation of gas beneath the station—a gas-works being near by. The brief accounts of the matter appearing in the Electrical Press make no definite pronouncement as to the cause; but a statement has been made that it was due to an "unusual and mysterious bursting of a transformer."

Public Lighting Difficulties at Stockport.—Minutes submitted at the monthly meeting of the Stockport Town Council stated that the Chairman of the General Purposes Committee had instructed the Gas Engineer (Mr. S. Meunier) to light one-half of the lamps in the borough, and that 1237 lamps were up to Nov. 19 being lighted out of a total of 2900. The delay in putting the lamps into lighting appeared to be due to shortage of labour. One or two councillors remarked that the lighting was not all it might be; but Mr. Winter (the Chairman of the Gas Committee) assured the members that everything possible had been done. They were prepared at the gas-works to take on a hundred men; but they could not get them. The Committee were willing to light all the lamps, if the Council would find the labour. It was pointed out that 250 automatic lighters had been ordered, and the procuring of another 500 was contemplated.

REGISTER OF PATENTS.

Production of Ammonia Compounds.

RIGBY, T., of Dumfries, and WETCARBONIZING, LIMITED, of Dean Farrar Street, Westminster.

No. 18,558; Aug. 11, 1914.

This invention relates to the production of ammonia compounds by employment of peat as an absorbent or fixing agent, as in the re-very of bye-products from gas generated by the gasification of nitrogen-ntaining fuels, such as peat.

As a result of experiment, the patentees claim to have found that at, which in a wet condition has been subjected to heat to produce thout evaporation such a change therein as renders the bulk of its ter readily expressible, as in the process of wet carbonizing [for ample, patents Nos. 10,834 of 1903, 17,610 of 1911, 17,427 of 1912, 73, 9392, and 11,133 of 1913], is capable of absorbing ammonia and nverting it into a compound of ammonia with humic acid or analogous terials of sufficient stability not to part with ammonia certainly at nperatures below 100° C., and probably not even until a much higher nperature is attained. Accordingly, they employ peat which has en heat-treated in the above way, as an absorbing or fixing agent for monia, and especially in connection with the absorption of ammonia m the gases of ammonia-recovery gas-producers.

The invention may be carried into effect in conjunction with pro-sses for peat gasification, as described in patents Nos. 17,610 of 1911 25,146 of 1912. The results obtainable under any particular condi-ns depend largely upon the character of the peat itself. Thus it is nd that a well decomposed peat containing a large percentage of ash s incapable of absorbing ammonia to any appreciable extent—parently owing to the humic acid in the peat having been neutralized the alkali in the ash. By exposing a young heat-treated peat in a rly dry and dusty condition to ammonia-containing gases they have, wever, been able to increase the original content of fixed nitrogen in peat from 1·25 to 4·5 per cent., and in one case even to as much as er cent., "which would indicate that the greater the amount of free mic acid in the peat, correspondingly greater will be its power to sorb the ammonia."

Apart from the reduced cost of thus preparing peat for use as an sorbent or fixing agent, which the method renders possible—especi-y when considered in connection with peat-treating processes of the aracter above indicated—the fixed nitrogen is rendered available in product in an easily assimilable form for manuring and fertilizing rposes, apparently owing to the destruction of the slimy matter and rendering truly spongy of this organic material.

Eliminating Sulphur from Oils.

EVANS, E. V., and the SOUTH METROPOLITAN GAS COMPANY, of Old Kent Road, S.E.

No. 22,147; Nov. 6, 1914.

The patentees point out that it is known that when the vapour of oi ntaining sulphur is heated with hydrogen an elimination of sulphur sulphuretted hydrogen, occurs, and in one process which takes vantage of this fact the hydrogen is produced by mixing the oil pour with superheated steam and passing the mixture over coke ated to redness—the coke at the same time producing intimate con-t between the steam and the oil, which is cracked at the tempera-e used. By the present invention, the whole or a part of the sulphur esent in an oil may be eliminated as sulphuretted hydrogen by heat- the oil in the presence of hydrogen or gas containing free hydrogen a catalytic agent or contact substance.

In the case of an oil of suitable boiling point, the vapour of the oil xed with a small proportion of hydrogen (5 or 10 per cent. of its ume) may be passed over the heated catalyst and the sulphuretted drogen may be removed from the vapour by absorption by any own agent for the purpose, or the oil may be washed after conden-ion to the liquid form.

The process appears to be applicable, the inventors state, to all oils ntaining sulphur. The most efficient temperature of working is in region of 400° to 500° C.; for at this temperature the iron pipes ich contain the catalyst are not destroyed, and the velocity of the ction is so high that a relatively small area of contact is required. the other hand, certain oils are decomposed at these temperatures; when this is to be avoided, lower temperatures must be employed. this end a relatively greater surface of contact will be necessary, in der to bring about a similar effect as at 400° to 500° C. It is neces-y, therefore, to determine with each particular oil the maximum nperature below 500° C. at which the oil is not decomposed, and to ow sufficient contact with the catalyst to ensure that practically the ole of the sulphur of the oil is converted into sulphuretted hydrogen e deposition of carbon on the catalyst is not a measure of the extent the decomposition of the oil; for the sulphur compounds on decom-sition yield carbon. The yield of oil before and after treatment is criterion from which the extent of the decomposition must be lged.

Certain substances act catalytically in promoting the decomposition sulphur compounds. Nickel, iron, cobalt, copper, and a number of ier substances (that have from time to time been proposed for the composition of sulphur compounds in coal gas) deposited in porous clei, or used as such, may be regarded as catalysts to the decompo-on; while such substances as pumice, fire-clay, asbestos, &c., appear ly to act as promoting contact, and are termed simple contact sub-nces. The effect of a catalyst is to reduce the contact necessary, thus the size of plant; and the superiority of reduced nickel, pregnated on a porous medium, such as fire-clay, over (for example) bestos used as a contact substance, is very marked.

Hydrogenation of the oil does not take place, probably owing to the oisoning" effect of the sulphur on the catalytic or contact action.

As a typical example of the application of the process, it may be assumed, the patentees say, that naphtha is being distilled from crude coal tar. The vapours from the head of the still or at the exit of the fractionating column or dephlegmator, if used, are conducted to a furnace maintained at 450° C., and in which steel or iron pipes are contained. A convenient arrangement for these pipes is in the form of a U. The vapours enter at the top of one limb, and in descending are brought to the temperature of the reaction; and to enhance this, the limb may be packed with non-combustible material. In the second limb, the catalytic material is placed. This may be prepared by steeping highly porous fire-clay spheres, about 1 inch in diameter, in a saturated aqueous solution of nickel chloride, and reducing the salt by subjecting the spheres to a stream of hydrogen or coal gas at a temperature of 300° to 350° C.

Assuming that the rate of distillation is 50 gallons per hour, then the volume of each limb of the U tube should be about 7·5 cubic feet. It may be advisable to attain the volume required by a multiple of smaller tubes; and the former or preheating limbs may be advantageously filled with fire-clay spheres which have not been steeped in nickel salt solution.

A stream of hydrogen or coal gas is introduced at the inlet of the preheating tube or tubes, and allowed to flow with the vapours at the rate of about 400 to 500 cubic feet per hour when the rate of distillation is 50 gallons per hour. Only a small portion of this hydrogen is actually used; and it is advisable to pump the hydrogen over in a closed circuit consisting of reaction tubes, vapour condenser and receiver, meter, pump. The sulphuretted hydrogen produced, as a result of the decomposition of carbon bisulphide and sulphur compounds, is washed from the condensed vapour by caustic soda solution, or may be extracted direct from the vapour by means of an oxide of iron purifier kept sufficiently warm to prevent condensation. The periodic revivification of the catalytic material may be conducted by aeration in the usual manner.

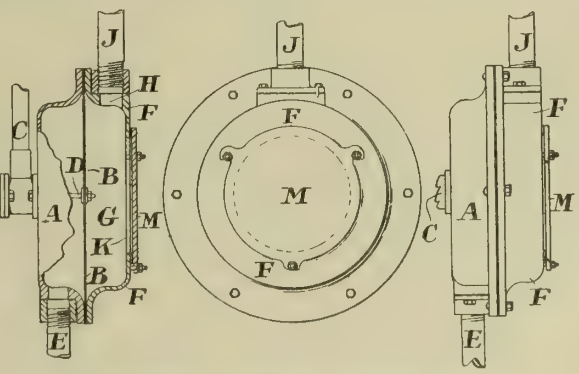
In the case of an oil which cannot be distilled, or, indeed, of an oil capable of distillation, the catalytic substance may be introduced into the liquid oil, which is suitably heated while hydrogen is passed through it; or the heated oil may trickle over the contact substance while hydrogen is at the same time passing over it. As already stated, hydrogenation does not occur.

Gas-Bags for Gas-Engines.

FAIRWEATHER, W., J., & W. R., of Blenheim, New Zealand.

No. 20,594; Oct. 6, 1914.

The gas-bag or regulator according to this invention consists in the combination of a casing, one side of which is closed by a substantially flat diaphragm, a valve (actuated by the movements of the diaphragm, and arranged on the side of the casing opposite the diaphragm) controlling the supply of gas to the engine, a gas-outlet between the diaphragm and the valve, a rigid cover extending over the diaphragm on the side away from the valve, and an inspection opening normally closed by a gas-tight cover.



Fairweather's Gas-Engine Regulating Bag.

A cross-sectional elevation of the gas-regulator, and a back and side elevation are given.

The regulator is formed in the usual way with a solid metal wall A with a flexible wall B of fabric material. C is the gas inlet controlled by the valve D attached to B, and opened and closed as the fabric is drawn in and bulged out by the exhaustion and filling of the regulator casing. E is the outlet from the regulator for conveying the gas to the engine. It is between the diaphragm and the valve. F is a metal cover secured over the back of the wall B by bolting its flange to the flange of the wall A—the edge of the fabric being held between the two flanges. The cover is shaped so as to leave sufficient space G between its inside and the back of the fabric to permit of the full distension of the wall B in the working of the engine. It is formed with an aperture H at the top, from which a pipe J is led away to any desired point.

The cover is formed with an inspection opening K that is normally kept closed by the plate M fitted over it and secured by the nuts to make a gas-tight joint.

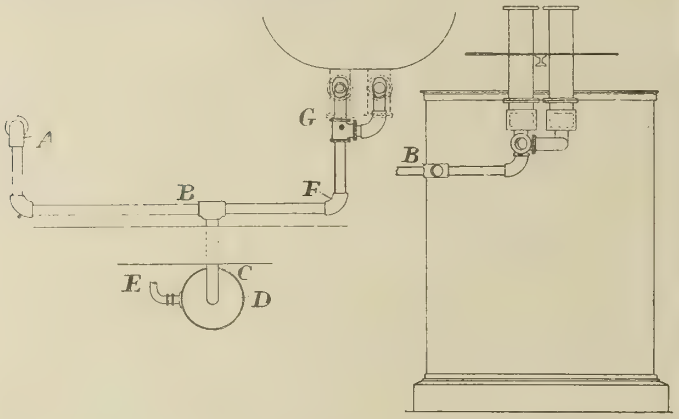
Using Exhaust Steam in the Manufacture of Water Gas.

SMITH, H. E., of Putney, S.W.

No. 23,052; Nov. 25, 1914.

This invention relates to the intermittent type (alternate "run" and "blow" type) of water-gas producers, as described in patent No. 24,893 of 1908, in which the superheating of the steam is carried out, with the object of providing for the utilization of exhaust steam without superheating.

The air blast to such plants is usually provided, the patentee says, by a steam-turbine coupled to a fan kept running continuously while the plant is at work, although the "blow" is only required for about one minute in every six. A continuous stream of exhaust steam from the turbine is therefore allowed to escape to the atmosphere in excess of the amount required for gas making. To enable this exhaust steam to be utilized, the inventor arranges an intervening liquid seal between the turbine and the inlet valves of the producers.



Smith's Apparatus for Using Exhaust Steam in Water Gas Manufacture.

A side elevation of a portion of an intermittent water-gas plant is given; also a plan of same.

To the exhaust pipe A on a steam-turbine, there is fitted a T-shaped connection B; and to the lower end of the latter is connected a depending pipe C the open end of which is caused to dip into a liquid seal contained in a seal pot or vessel D provided with an adjustable overflow E, in order that the amount of seal on the pipe may be regulated to suit different requirements. From the other end of B a pipe line F is carried to the inlet steam-valves G on the water-gas producer.

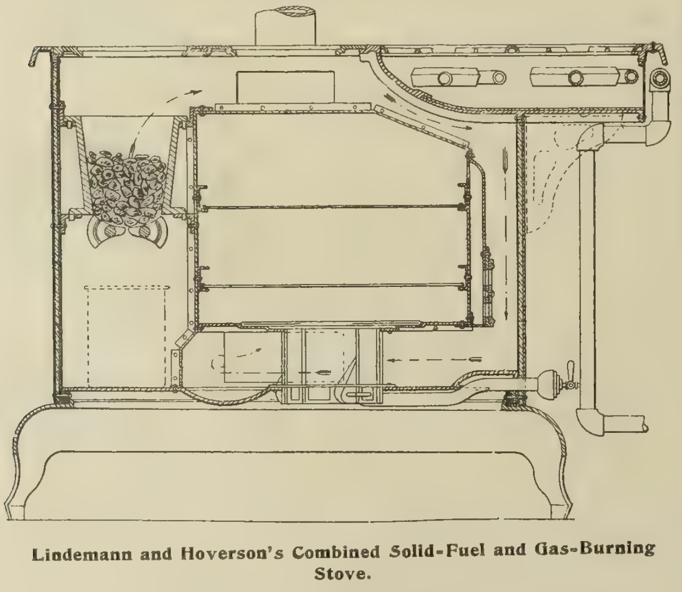
With a double generator plant the steam-valve may be in the form of a four-way valve by which the current of exhaust steam coming from the turbine during the "blow" can be given free outlet into the atmosphere, and thus relieve the turbine of back-pressure during the periods when the utmost output is required. By a turn of the valve G to the right (or left), the current of steam can be directed into either of the generators as required as soon as the "blow" is ended. The required pressure for this steam can be freely adjusted by the depth of the seal in D, and the inlet valve G can be so restricted that any excess of steam in the pipe A escapes at the seal-pot D.

Combined Solid-Fuel and Gas-Burning Stove.

Lindemann, A. J., and the A. J. Lindemann and Hoverson Company, of Wisconsin, U.S.A.

No. 23,680; Dec. 7, 1914.

This invention relates to a stove designed for baking and over-fire cooking, so as "to economically provide simple, compact, seam-tight, and efficient stoves, each constructed to permit the use of either solid or gaseous fuel without necessitating the removal or replacement of any of its parts, and in which both kinds of fuel may be utilized at the same time." A novel flue system of the stove serves, it is said, for ample draught for the combustion of the solid fuel, gas, or both, as well as to economize space for chambers in which are located the gas-burners for oven-heating and over-fire cooking, so that none of the products of combustion of the solid fuel can enter the chambers.



Lindemann and Hoverson's Combined Solid-Fuel and Gas-Burning Stove.

The structural peculiarities of the stove will be apparent from the accompanying illustration—a vertical longitudinal sectional view.

The specialities claimed are: Mechanism for adjusting a plate to act as a gas-flame deflector or to shut off the flame from the oven, and mechanically adjustable to control the communication of the gas-burner chamber with the oven; a gas-burner chamber disposed below the bake-oven and secured to the bottom of it—the chamber extending across a flue-space in the stove between the bottoms of the oven and the stove; and an operating rod extending beyond the wall of the stove with a toggle-joint connecting the operating rod with the plate. A flue conducts the products of solid fuel combustion from the fire-pot of the stove around and under the oven; while the gas-burner located beneath an opening in the bottom of the oven, with a vertically movable plate for controlling the opening, permits it to be either open or closed above the burner, so as to constitute a flame-deflector when elevated above the oven-bottom. The chamber in which are the gas-burners is isolated; the bottom of it comprising a partly horizontal and partly curvilinear solid plate shaped at the upper extremity of its curve to form a ledge upon which to rest a removable top-plate of the stove, whereby the plate constitutes a supplementary part of the top-frame of the stove.

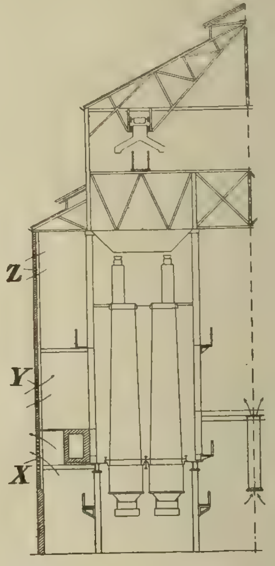
Ventilation of Retort-Houses.

Duckham, A. M'D., of Ashtead, Surrey.

No. 24,289; Dec. 18, 1914.

Trouble has been experienced, the patentee says in his specification, with the ventilation of retort-houses installed with vertical retorts. The air entering on the ground level becomes heated by contact with the supporting ironwork and mouthpieces around the bottom of the retorts from which the coke is discharged, and is further heated by contact with the brickwork forming the bottom and sides of the settings. This heated air ascends, and causes inconvenience to the attendants working on the intermediate platforms and on top of the settings.

To remedy this defect, he proposes to cover over at the most convenient position up the sides of the settings, the space between them and the retort-house walls, so preventing the ascent of the hot air. In order to ventilate any stages that may be formed between two benches of settings, air-ducts are constructed from these stages, running downwards to such a level above the ground floor that cool air only enters, or the ducts may be extended to the outside of the building. The cool air is then admitted through the floors of such stages, which act as covers to exclude the heated air.



Duckham's Arrangement for Ventilating Retort-Houses.

A vertical section of a retort-house constructed according to the invention is shown. Openings X are provided in the outer walls through which the air, heated by contact with the bottom of the settings, can escape. Through other openings Y Z cooler air can enter from outside for the ventilation of the intermediate platforms C and platforms D at the top of the settings. A cover B, between the settings and the outer walls, shuts off the space above it ventilated by the air entering through the openings Y from the space below.

For the purpose of ventilating stages between two benches of settings, ventilating shafts E are carried downwards to a level which ensures the supply of cool air. The tops of the shafts would be covered by gratings. In this case the raised floor F acts like the cover B, and the cool air is passed through it.

Burners for Welding.

M'Gowan, R. R., of Lincoln.

No. 672; May 17, 1915.

This burner is intended particularly for welding seams in metal boiler flues, tubes, tyres, angle rings, T-rings, air reservoirs, flanges, and similar parts. The invention is described in the specification as applied to the type of apparatus comprising a supply pipe divided by a usual Y branch into two supply pipes. Upon the end of each is provided a burner—the burners facing towards one another and being adapted to be simultaneously applied to the joint upon opposite sides. A burner according to this invention comprises a box provided with a removable cover upon one end, and a recessed or channelled plate disposed within the burner-box, and adapted to be slid out from it through the open end when the cover is removed. The plate is provided at each side of the recess or channel with perforations through which the gases pass to be burned within a longitudinal slot in a block of refractory material secured upon the face of the burner-box. The gas (mixed with a suitable quantity of air) is supplied through the divided pipe to each of the burner boxes, and, escaping through the aperture therein, "burns fiercely in the longitudinal slot in the refractory material secured upon the opposing faces of the burners."

PARLIAMENTARY INTELLIGENCE.

BOARD OF TRADE PROVISIONAL ORDER.

ong Eaton Gas.—In addition to the notices for the 1916 parliamentary session which were referred to last week, the Long Eaton Gas Company intend to make application to the Board of Trade for a Provisional Order to authorize them to acquire further land and construct additional gas and residual products works.

HOUSE OF COMMONS.

Nitrate of Soda.

Sir Archibald Williamson asked the Parliamentary Secretary to e Board of Agriculture what was the usual annual consumption of rate of soda as a fertilizer in the United Kingdom, and whether the nsumption had increased materially during the last ten years?

Mr. Acland replied that the normal annual consumption of nitrate soda in the United Kingdom was about 120,000 tons, of which it d been estimated that about two-thirds, or rather more, are used as fertilizer. There was no evidence of any material increase in the nsumption during the past ten years, but he hoped that, in view of e appeals made to farmers to increase the production of the land, ere would be a substantial increase in the quantity of all kinds of tilizers required during the present farming year, if adequate supes can be made available.

Risks to Workers on Trinitrotoluene.

Replying to a question by Mr. Will Thorne, as to the health of work- n employed in the use of picric and nitric acids at Woolwich senal, Mr. Lloyd George says he is informed that, as regards picric d, no ill-effects are caused except a discolouration of the skin; but t workmen engaged on trinitrotoluene are sometimes injuriously ected, the degree of susceptibility varying greatly, many workers ng immune. Various expedients of a sanitary and medical character e in operation to counteract the difficulty; and a weekly medical mination of all workers is carried out with a view to the transfer to er work of persons specially susceptible.

LEGAL INTELLIGENCE.

DARWEN "MUNICH" CHAMBER INSTALLATION.

German Contracts and the War.

t the West Riding Assizes, Leeds, last Wednesday, before Mr. tice Atkin, the hearing was commenced of an action in which Messrs. eph Morton, Limited, fire-brick manufacturers, of Halifax, claimed inst Messrs. R. & J. Dempster, Limited, of Manchester, in respect goods sold and delivered.

Ir. E. Tindal Atkinson, K.C., and Mr. Mortimer were for the intiffs; Mr. F. Newbolt, K.C., and Mr. R. A. Shepherd were for defendants.

Ir. Tindal Atkinson explained that in December, 1913, the Darwen rporation proposed to erect what were known as "Munich" chamber ns at their gas-works. The ovens were a Munich invention; and it s intended that another German firm, the Stettiner Company, should ply what fire-clay and other technical materials were required for rying out the work. The defendants were to provide the ordinary a constructional work. An agreement was entered into by the rwen Corporation, the Munich people, the Stettiner Company, and defendants to carry out the work. According to the agreement, it s to be done partly by the defendants and partly by the Stettiner npany. The defendants made themselves directly responsible for completion of all the work between themselves and the Corpora- ; the Stettiner Company undertaking to indemnify the defendants inst any failure to supply the defined quality and kind of material. en war broke out, the work had not been completed. The plaintiffs been employed by the Stettiner Company to supply fire-clay erial, mostly in the shape of bricks; and at the time that war broke they had supplied a large quantity of material, valued at about o. Just as the war started, the Stettiner Company sent a cheque a sum of £250. But in consequence of the war the cheque was not oured; and the plaintiffs had received no payment at all for any erials supplied to the Stettiner Company. The effect of the war to dissolve contracts with enemy subjects; and the plaintiffs, if had thought fit, could have refused to deliver any further goods the undertaking for which defendants were responsible to the wen Corporation. He could not prove that any definite agreement rder was sent by the defendants to the plaintiffs; but when war e out there were a number of German workmen on the works, loyed by the Stettiner Company. The work might have been ped; but the defendants, in order to ensure its being continued, ertook, as a matter of fact, to pay the wages of the workmen. This ngement continued until October, when the German workmen were duly interned. The defendants were receiving, and had, in fact, ived, a large proportion of the £9000 they were entitled to get the Darwen Corporation in respect of the work the Stettiner Comy were expected to do. The defendants had £6000 of this sum in r hands, which they held as representing the amount of work done the Stettiner Company, and further representing the amount of erial the plaintiffs had put into the work. The defendants took up position that they were neither morally nor legally liable to pay the ntiffs any of the money which was represented by the delivery of the goods. The value of the bricks sued on as delivered after the outbreak of war was £264.

Evidence was given by the German Engineer of the Stettiner Company and Mr. A. H. Smith (the Darwen Corporation Gas Engineer).

Mr. Newbolt said this was an action for goods sold and delivered against the defendants, when they had a contract for similar goods with another party. This excluded any idea of an implied contract. His learned friend had omitted to say that the plaintiffs had got judgment against the Stettiner Company for all the bricks supplied before Aug. 1, and they had garnisheed in the High Court the money which the defendants were alleged to hold on behalf of the Stettiner Company, and an issue had been directed in the proceedings. Furthermore, the plaintiffs had based their argument upon ground which was altogether irrespective of the war. It had been said that the goods were delivered for work which the defendants were obliged to complete, and that the defendants had had the benefit of such goods. Therefore, if the goods were delivered on to premises where a contract was being completed, and a person got the benefit of them, that person was liable to pay the sub-contractor. This view was absolutely erroneous.

His Lordship asked whether it was the case for the defendants that they were lending money to the German Company after the outbreak of war.

Mr. Newbolt: We were lending money to the agent of the German Company; and if he was acting lawfully as agent, then we were lending to the German Company. If he was not lawfully acting as their agent, then we were lending it to him.

His Lordship, in giving judgment, said the contract was to be completed in a certain time, and the work was to be done in this country. Therefore it was now void, or suspended. It appeared to him that the contract during the war had been performed by the German Company, and for the reason of this one had only to look at the proclamations which were made from time to time under the Trading with the Enemy Act, which was passed immediately after the outbreak of war. The Act in itself, or the amending Act, was passed on Sept. 18, 1914, and contained certain prohibitions, one of which was not to trade or carry any merchandize from an alien enemy, or enter into any new commercial or financial obligation with any person in the German Empire. But this did not alter the common law; and it seemed to him that the contract should have been performed. This was the position so far as the German Company were concerned. If the parties had acted as they ought to have acted, they would have taken legal advice as to their position. It seemed, at any rate, that the plaintiffs were in doubt as to what should be done, because at some period after war broke out they communicated with the Darwen Corporation, as to what their position was; and Mr. A. H. Smith (the Gas Engineer to the Corporation) informed them that arrangements were being made by which they were to be paid by Messrs. Dempster. It was sufficient to say that they went on delivering the fire-clay bricks. Up to the date of the war breaking out the German Company carried out their part of the contract. They sent workmen over; but when war broke out it was illegal for Germans to continue the contract, and they were not in a position to make remittances. The men had to be paid; and so Mr. Diehl got into communication with defendants, and he asked for an advance. The defendants, in reply, wrote to him a letter in which they said they were arranging an advance on account of work done, and asked for a receipt. They sent sums of money for the payment of the German workmen; and in this manner the work was completed, so far as the fire-clay bricks were concerned. In this way, the defendants were able to perform their contract with the Corporation and discharge their obligation with that body. By reason of this completion, the defendants had secured payment from the Engineer to the Corporation representing the value of the work. As a matter of fact, they had been paid the full amount of the work, less 10 per cent. retention money. The money which had been paid them they had in hand at the present moment. In their own interests, in order to fulfil their legal obligation with the Darwen Corporation, the defendants took over the German workmen, paid them over sums of money, and used the materials supplied by the plaintiffs. If the defendants used the materials of the plaintiffs for their own advantage, and accepted them when they were delivered upon the land, then there arose in his mind an implied obligation to have to pay the price of them. This seemed to him what had actually happened in the case. The defendants tried to establish that the contract had not come to an end between the German Company and either the plaintiffs or the defendants. They said first of all this was a contract made with a branch of the German Company, and therefore the matter came within the terms of the proclamation dated Sept. 9, 1914, which provided where the enemy had a local branch, locally situated in British or neutral country, such a transaction would not be with the enemy. The German Company had sent over a number of workmen, under an engineer, for the performance of the contract; and he was satisfied upon the evidence that the German Company had no branch locally situated. Whatever the meaning of a "branch" was, it appeared to him it was not satisfied merely by a German Company sending over a number of workmen. It involved an office or workshop which could be said to be situated in this country. This it was said that the agency of Mr. S. N. Wellington, who was agent to the German Company, continued by reason of the law relating to the contract of agency. He was not to decide whether a contractural relation between the German Company and Mr. Wellington continued at all; but it concerned the question of the relationship of Mr. Wellington as the agent for the German Company. Their relations were covered by the law he had dealt with. It seemed to him, whether his contractural relations with the German Company continued or not, this would not help the defendants. It was suggested, further, that after the war Mr. Wellington in some way became principal of the German Company; but it would take a great deal to satisfy him that the relation did arise, that Mr. Wellington undertook to complete the contract or retain the right to complete the work. He had no evidence of this except that plaintiffs seemed to have from the beginning debited the goods to Mr. Wellington. He was satisfied that the goods were ordered, and supplied to the Company before the war broke out; and he did not see why after the war the relationship was changed as between themselves and the German Company, and Wellington became to them a principal. If this was so, the defendants would have to say that, while the contract was being carried out by the German Company, when they were making advances of money, they were really lending money to an alien enemy for the purpose of enabling them to complete a contract which would entitle the alien enemy to be paid after the war a substantial sum of money. If this contention were really true, it appeared to him that it would amount to this—that the defendants were setting up, in fact they were committing, a breach of the law in reference to trading with the enemy, because it seemed to him quite plain that they would then enter into a financial contract for the benefit of the enemy. That would be like lending money to the enemy. They would be committing a plain breach of the law in this respect. He could not think that this was the true meaning of the transaction. To his mind, the whole transaction was that the defendants paid the workmen in their own interest, employing the workmen to complete the contract which the German Company were necessarily unable to complete, and that they would, after the war, adjust the remuneration so as to get the benefit of the completion of this part of the work. He doubted very much whether the plaintiffs or the defendants had at all carefully considered what the exact position was. He thought the plaintiffs were groping to some extent to find out what was the real position. He considered he was only doing justice to the defendants in inferring that they were not committing a criminal act, but were obliged in their own interests to complete a contract which they had entered into. The defendants had completed it; and, on accepting the goods for the purpose of completing it, it seemed to him they were under a contractual obligation to pay for the goods. He was all the more satisfied to come to this conclusion when he bore in mind that the defendants had banked the sum of money they had received from the Corporation, the very price of the goods for which they were sued; and they would otherwise hold it, till they were asked to account for it to the German Company at the close of the war. No question had arisen as to the price; and, in entering judgment for the plaintiffs with costs, he felt that the right price was the contract price.

Disputed Tar Contract.

Last Thursday, at the West Riding Assizes, Leeds, before Mr. Justice Atkin, the Cortonwood Collieries Company, Limited, brought an action in respect of goods sold to the Burnden Tar Company (Bolton), Limited. The defendants were not represented. His Lordship gave judgment, with costs, for the amount claimed, £158 17s. 4d.—the balance of an account for £458 17s. 4d., in reference to a contract entered into for the supply of tar.

Action for Personal Damage.

On Monday last week, in the High Court of Justice, King's Bench Division, Mr. Justice Darling and a Special Jury had before them an action in which Mr. J. A. Hutchison, the Managing-Director of the Burnden Tar Company (Bolton) and Hutchison's Limited, of Highbridge, Somerset, sued a Motor Company for damage to a motor-car and personal injury. The Jury returned a verdict for the plaintiff, assessing the damages at £200. But, inasmuch as the defendants had paid £422 into Court before the action was heard, judgment was entered for them with costs after the date of payment into Court—the plaintiff to have the costs up to that date.

Assault by a Gas-Works Labourer at Sheffield.

On Monday of last week, at the Sheffield Police Court, Arthur Kirkham, a labourer, was sentenced to a month's hard labour for an assault on Mr. Robert Neill, Works Manager at the Neepsend station of the Sheffield Gaslight Company. It was stated that the defendant was employed as a labourer, and for some time had been engaged in pouring pitch into granite sets. On the day before the assault, he saw Mr. Neill in the yard, and complained that he did not consider his job to be labourer's work. He then left. On the following day he went to the time office and told the timekeeper that he had come for his leaving certificate; and if it was not given him he would hit Mr. Neill on the nose. Mr. Neill refused him the leaving certificate, because he was wanted by the Company. Defendant then asked for a job; and the complainant said he would be taken back on the old conditions. Defendant said he wanted more money; and upon Mr. Neill remarking he had nothing to say on the point, defendant struck him with his fist in the mouth. Complainant lost three teeth, his upper lip was cut, and his nose very badly hurt. The Company regarded the assault as serious. Mr. Neill was also tired of the fine lines that workmen were drawing as to what was a labourer's work, and what was not. The defendant admitted that he had struck Mr. Neill.

Electricity Failure at Wednesbury.—During some portion of last Tuesday evening, Wednesbury suffered the not uncommon experience in places electrically lighted, of a failure in the supply of current. So far as business premises were concerned, alternative methods of illumination were promptly resorted to; but the inconvenience was greater in the case of many of the works turning out munitions of war, which take current from the generating station for lighting and power purposes.

Chertsey Gas Company.—The shareholders were congratulated upon the position of affairs revealed by the report which the Directors submitted at the annual meeting of the Chertsey Gas Company. The increase of 3d. in the price of gas which the heavy cost of coal had necessitated, compelled a reduction of ½ per cent. in all classes of shares which were under the sliding-scale; but under their Act, the dividend on the new capital was allowed to remain at 5 per cent. There was some diminution shown in the output of gas, owing to decreased consumption both in public and private lighting. The services of the Secretary (Mr. H. J. Hamilton) and of the Manager (Mr. F. G. Matthews) were acknowledged; the Chairman (Mr. W. Moir) remarking that the great difficulties encountered in securing delivery of coal had been overcome by the untiring energy of these two officials.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

In the report for the year ended June 30, which will be submitted at the meeting of proprietors next Tuesday, the Directors state that the balance at the credit of the revenue account at June 30, 1914, was £66,356. Since that date, the dividends paid have been: 7 per cent. on the preference stock, £14,000; 4 per cent. on the ordinary stock, £32,000. Adding to these supplementary income-tax £1202, and subscriptions to war funds authorized at the last general meeting £500, makes a total of £47,702—leaving a balance of £18,654.

In consequence of the adverse conditions arising out of the war, chiefly the unprecedentedly high freights to French and Italian ports, and the high cost of coal, no revenue has been received during the year in respect of the Company's large Continental interests. Consequently the greater part of the Company's capital has been unproductive. After adding such minor interests and dividends as were received, and deducting the management and pension charges and income-tax, the amount to be carried forward to next year is increased to £20,301.

The reasons which prevented the declaration of any dividends in respect of the Continental properties during the year, also caused the Cie. L'Union des Gaz to postpone the distribution of the final dividend declared by it in respect of the previous year, amounting on this Company's holding to £29,967, and included in the accounts for last year. In these circumstances, the Directors of the Continental Union Gas Company regret that they are unable to recommend the declaration of a dividend on either class of stock, in respect of the balance of £20,301 at the credit of the profit and loss account, which depends on the collection of the postponed dividend.

The report is signed, on behalf of the Board, by Mr. George A. Touche, as Acting-Chairman.

LEICESTER GAS-WORKERS' WAGES.

Some important questions concerning the remuneration of employees in the Corporation Gas Department were debated at the meeting of the Leicester Town Council last Tuesday; a suggestion being forthcoming in the course of the discussion that the responsible Committee were endeavouring to shirk their obligations in relation to a decision upon the subject of a war bonus by relegating it to a Special Committee.

There was no objection to the first portion of the Gas Committee's report, which was adopted upon the proposal of Mr. Hilton, seconded by Mr. Carver. This provided for an advance of 3s. a week during the war to the inspectors, stove fitters, and fitters' labourers working with engineer, and a 6 per cent. increase on the piecework prices of the purifier men. It was as to the rest of the report of the Committee that a sharp difference of opinion arose, the proposal which was submitted by Mr. Hilton concerning an application which had been received from the National Union of Gas Workers for a war bonus of 12½ per cent., and that time-and-a-half should be paid for Sunday work; there being also the further question raised as to granting a war bonus to the clerical staff. The Gas Committee, of whose recommendation Mr. Hilton moved the adoption, had suggested that a Special Committee should be appointed to deal with these several applications; but Mr. Murby proposed the reference back to the Gas Committee of this part of the report, with the proviso that any recommendation which they might adopt should be retrospective from the date of such recommendation. Mr. Salt seconded the amendment, entering a protest against the manner in which the matter was discussed and the brisk and careless way in which it was disposed of. Mr. Carter denied that the matter had been rushed through, and strongly supported the reference to a Joint Committee. Mr. Sherriff avowed that the Gas Committee dare not face the situation. The question was brought to the Council so that they might appoint a representative Committee and the whole responsibility be taken off the shoulders of the Gas Committee and placed on those of a Special Committee.

Mr. Hilton, in replying on the discussion, expressed his astonishment at the attitude certain members of the Gas Committee had taken up on this point. Mr. Murby and Mr. Salt were both present at the meeting of the Committee, when it was moved and seconded that the matter should be referred to the Council. The proposition was put, and he believed it was carried unanimously. Mr. Salt said he thought Mr. Hilton's memory failed him. They all discussed the matter, and at the close they were disgusted with the suggestion.

The amendment was negatived; the proposal submitted by Mr. Hilton being adopted, and a Special Committee, with the Mayor at its head, was appointed. An amendment, submitted by Mr. Kelly, that the Committee should consist of three members from each of the three sections of the Council, in addition to the Mayor, was defeated.

WEST BROMWICH GAS UNDERTAKING.

At a meeting of the West Bromwich Town Council last Wednesday, Mr. J. Brockhouse (the Chairman of the Gas Committee) referred to the communication from the War Office on the subject of benzol and toluol. He said he believed the Council and the public would sympathize with the Committee and the Manager (Mr. W. H. Johns) in the difficulties they were experiencing at the present time; and all they asked was that the consumers would be as considerate as possible with them. It had been made clear to them that the Government required all the toluol and benzol they could get; and though gas undertakings were not yet compulsorily made to extract these constituents, at most gas-works the process of elimination was in operation. The ect of the extraction of toluol and benzol from the gas was to reduce illuminating power; but in all the modern methods of using gas, is was unimportant. It was the calorific value of the gas which unted to-day. He advised those consumers who had not yet opted incandescent burners to do so. He hoped people would be oroughly patriotic in the matter, and would willingly submit to any convenience to which they might be put. Owing to the depleted ff through the war, it was not the intention of the Committee to e on any more consumers for maintenance at present.

NOTICES HANDED IN AT MARYPORT.

The Dispute Settled.

An application from the men employed at the Maryport Gas-Works an increase of wages, backed up by notices handed in to cease work, s been met in an amicable spirit by the Council, with the result that notices have been withdrawn.

The men asked for an all-round advance of 4s. per week. They are ng paid trade union rates; stokers receiving 6s. per shift, and labourers , *plus* a war bonus of 2s. or 3s. per week according to wage, and a oduction bonus of 1½d. per 1000 cubic feet made above a minimum 22,000 cubic feet per shift. The Council felt they could not go be- nd this, but granted some minor concessions; and as the notices had parently been handed in under a misunderstanding as to the Council t dealing promptly with the matter, they were withdrawn. An ad- nce was conceded for "pipe-jumping;" and all work will in future ise, or overtime commence, at noon on Saturday.

Stripping Town Gas for Benzol.—The action of the Government securing the removal of those constituents from gas which are eded for making high explosives, led "J. O.," in the "Westminster zette," to refer to the stripping of town gas for benzol from the int of view of the motorist. He remarks that, "as an ordinary com- rcial enterprise, the plan was pretty hopeless; but now that national ergency has brushed all these obstacles away, it is not at all im- obable that after the war the changes effected in the use of gas for iminating and domestic purposes may lead to a reconsideration of whole benzol question by gas undertakings, who may find it more ofitable, after compensating consumers, to continue producing a ostitute fuel for motor vehicles and for internal-combustion engines nerally. The London gas-works alone are capable of producing million gallons of benzol a year; but by taking the total output at million gallons, and adding to it the roughly estimated 25 million lons increase from the various new recovery plants since the war gan, this would give us nearly all the fuel we need. In any case, wever, we may reasonably expect that the increase in the benzol oply will be large enough to bring down the price of petrol."

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

At a meeting early this week of the Edinburgh and Leith Corporations Gas Commissioners, a communication was submitted from Mr. Stewart, the Secretary of the Edinburgh Branch of the National Union of Corporation Workers. This stated that a mass meeting of employees at the Granton works and outdoor staffs had passed the following resolution: "That we ask the Gas Commission to receive a deputation to consider—(1) the increase in wages of 1d. per hour to the employees; (2) an increase in wages to surveyors, also to put them on the same basis as the collectors' department; (3) that all increases should affect all employees called up for Government service; (4) that all men in the employment of the Commission under the heading concerned must join the Union within fourteen days of the deputation being heard, otherwise a ballot of strike will be taken; and (5) that increases in wages be retrospective from the original date of application." It was agreed to remit the matter to the Works Committee, with instructions to receive the deputation. Members were given to understand that by receiving the deputation they would not be prejudicing the question in any way.

At a sitting of the Glasgow Corporation Special Committee on Objections to Assessments, there were heard some appeals by owners against being charged at the usual rate of 15s. each light per annum for the lighting of private streets, courts, &c. In one case it was maintained that none of the lamps assessed for had been lit this winter; while in another it was stated that only two of them were lit. Mr. Alexander Walker, the City Assessor, said that the Act under which the assessment was charged set forth that owners in private streets and courts must provide proper lamps to the satisfaction of the Corporation Lighting Inspector, and that the Corporation were entitled to charge 15s. in respect of each lamp. If the lamps were not lit or not fully lit, a complaint should be made to the Town Council, who were the sole judges of the lighting requirements of the city. Mr. S. B. Langlands (the Lighting Inspector) stated that there were 6472 private lamps in the city; and of these 2584 were temporarily darkened in accordance with an order issued under the Defence of the Realm Act. Every year the Lighting Department had a deficit on these private lamps, of £3516. The cost of lighting each of these lamps was not 15s. as charged, but £1 12s. 5d. at present, owing to the war bonus and other charges. Appeals against the assessment had been made with regard to only 200 lamps out of the 2584 which were temporarily darkened. The Committee, after retiring, said, as the darkening was a temporary expedient under an order by the military authorities, they would continue consideration of the appeals until the middle of January. Instructions might be given at any moment releasing the order; and then the old order of things would be reverted to. Mr. Walker said that the effect of the decision might be to hold-up the whole of the owners,

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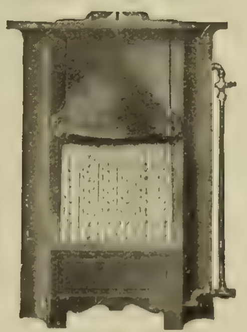
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assessments in which private lighting was included. The Chairman (Treasurer M'Millan) said he hoped owners would have the good sense to pay their assessments, and trust to the Corporation to refund the money if the appeals were sustained.

The Paisley Town Council met on Monday to consider the situation arising out of a strike of gas workers for an increase in wages. Subsequently the following official statement was issued to the Press: "The whole of the employees in the Corporation gas-works quitted the service on Saturday, on the termination of their notice under an application for an increase of wages. In February, the retort-house employees received an advance of 2s. 2d. per week—thus bringing their average weekly pay to 39s. 3½d.; and in February and May last, the labouring section received an advance of 3s., bringing the weekly pay to 29s. In view of these increases, the Corporation early last week decided to refer the matter of further increases to arbitration by the Board of Trade; but this was unanimously rejected by the employees. The supply of gas to several important works in town manufacturing munitions of war, as well as the town generally, being in danger of stoppage, the Council appealed to, and claimed the protection of, the Ministry of Munitions of War and the Board of Trade; and they at once agreed to send all the men required for the conduct of the gas-works, many of whom have had gas-works experience. These all arrived in town on Sunday at 6 p.m. On Saturday evening, however, the Gas Committee decided to offer the labouring section a further advance of 2s. 6d. per week; and the men having been specially summoned to meet at the gas-works on Sunday morning, this offer was made to them, and was accepted. The retort-house employees still remain out, but will be re-installed if they agree to arbitration by the Board of Trade, who have already offered their services. Meanwhile, consumers should take care to use as little gas as possible."

The Dundee Town Council have declined to sanction an increase recommended by the Gas Committee [*ante*, p. 503] of ½d. per hour in the wages of the labourers employed by the department. Members failed to see any reason why the present rate of 6½d. per hour should be increased.

It was reported by the Gas Manager (Mr. A. Thomson), at a meeting of a Special Committtee of the Inverness Town Council last Tuesday, that, owing to the unsatisfactory manner in which a number of stokers were performing their duties and irregular time-keeping, there was great difficulty in maintaining the gas supply; and that unless better work was done, the supply might fail. It was stated in the course of a discussion that the best class of stokers are serving with the Colours; and it was agreed to approach the Government with a view to releasing them for purposes of re-instatement.

The second annual report has been issued of the Foremen's Association of the Glasgow Corporation Gas Department. The report, which is signed by the President (Mr. G. L. Scott) and the Secretary (Mr. Richard Liggett), sets out the work accomplished during the year. The Association is a branch of the Municipal Employees' Association; but, in addition to being a trade union, it has certain educative objects.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 6.

Freight rates for pitch continue to be forced up, which does not help business. Continental buyers, however, who require pitch are more inclined to accept the position if freight does not rise still higher. To-day's price can be called 20s. per ton, net, at makers' works. Creosote continues firm at 4½d. per gallon, net, in bulk; solvent naphtha, 90-160, is 2s. 2d. per gallon, naked—both at makers' works.

There has been a further improvement in the position of sulphate of ammonia; and there is a good inquiry both for prompt and forward. The value to-day is certainly £16 10s. per ton, net, filled into buyers' bags, at makers' works, for 25 per cent. quality.

Tar Products in the Provinces.

Dec. 6.

There is no material alteration in the market for tar products. Business is very difficult to do in pitch; and though several parcels have been offered at low prices, the question of freight prevented the transactions going through. Creosote is very quiet, and reasonable prices are being accepted. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 9d. to 22s. 9d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 4.

Notwithstanding the fact that the market for this material has now attained the highest level since 1883, the tone has been still more vigorous, and further substantial advances have been recorded during the past week. The action of the Board of Agriculture in reserving supplies for home consumption has doubtless affected the position, and foreign buyers have shown great keenness in securing supplies over the next few months. The nearest prompt values to-day are £16 12s. 6d. per ton f.o.b. Hull, £16 17s. 6d. f.o.b. Liverpool, and £17 2s. 6d.

VICTORY

After careful investigation, the British Admiralty has approved the adoption of DAVIS Gas Fires for the heating of the Gun and Searchlight Stations throughout the country, and none but DAVIS Gas Fires will be purchased for this purpose by H.M. Office of Works.

With Britain at War, what but the BEST could possibly satisfy Admiralty requirements?

.b. Leith. For future delivery, it has transpired that £17 5s. per n has been paid for January-March, £17 for January-June, and 16 10s. for January-December, f.o.b. at the principal ports.

Nitrate of Soda.

This market is firmer, and spot quotations have been raised to s. 7½d. per cwt. for ordinary quality, and 15s. 9d. for refined.

Sulphate of Ammonia.

From another source, it is stated that this market appears to be going gher, and some very good prices are reported to have been paid for ompt and forward. Outside London, makes are quoted at £15 5s.; verpool, £16 to £16 2s. 6d.; Hull, £15 15s.; Leith, £16 5s.; and iddlesbrough, £16 to £16 2s. 6d.

COAL TRADE REPORT.

rthern Coal Trade.

The demand for coal is stronger, as is usually the case when the lidays are so near—at which time the production often increases. e shipments are fair in the circumstances of very high freights and scarcity of tonnage. In the steam coal trade, the demand is strong this season; and the prices for prompt supplies are firm. Best rthumbrian steams are from 20s. to 20s. 6d. per ton f.o.b.; second-ss steams are 17s. to 17s. 6d. per ton; and steam smalls are a little ner at 10s. 3d. to 12s. 6d. per ton f.o.b. There is not much coal e for sale for the rest of this month; and if the supply of shipping ntinues good, there is the probability of a full demand for some eks to come. In the gas coal trade, the long contracts now claim arge part of the output. Thus, with a production reduced by enlist-nt, the market seems to be firm, especially for occasional cargoes early delivery. Best Durham gas coals are 19s. 6d. to 20s. per ton .b.; second-class gas coals are somewhere about 17s. to 17s. 3d. per ; and for "Wear Specials," the quotation is now 21s. per ton f.o.b. e demand for coking coal is larger in Durham; and this has an ect on the gas coal trade and price. Although the rates of freight abnormally high, gas coal is being rather freely exported, especi-y to France and some other Southern European countries. To ndon, the current freight on gas coal is as high as 16s. To Genoa large market for gas coal), as much as 61s. to 64s. is the current tation; so that gas coal at that Italian port would be over £4 2s. ton—a record value. Naturally this limits additional sales. In e, the prices are firm all round. Gas coke is strong, though the duction is now heavy, and good makes are from 27s. 6d. to 29s. per f.o.b., according to the quality. Exports appear to be heavier, h of gas coke and of foundry coke; but there are the same difficulties o high freights and scarcity of steamers as affect the coal trade.

Torquay's Dark Streets.—Considerable dissatisfaction is expressed at Torquay over the decision of the Town Council not to light the street-lamps. The resolution of the Council took effect last week; and with the exception of a few lights on flights of steps and in other dangerous spots, the town was in darkness. Meetings of protest have been held by the Chamber of Commerce and by other bodies; and several memorials have been presented to the Council in opposition to what is regarded as the false economy of that body.

Shortage of Fireclay.—At a recent meeting of the Executive of the Miners' Federation, a letter was received from the Home Office suggesting that the Federation should consider the suspension of the Mines Eight Hours Act so far as it applies to fireclay mines. The Home Office communication pointed out that considerable difficulties were being experienced in connection with the manufacture of munitions by reason of the shortage in the supply of particular kinds of fireclay. It was agreed to write to the various districts in which fireclay mines are situated, asking for the fullest information as to how the matter stands. It was decided that a conference of the Federation should be convened to consider the matter.

Exmouth Public Lighting.—At a meeting of the Exmouth Urban District Council last Wednesday, the Committee appointed to deal with the accounts of the Exmouth Gas Company with regard to the public lighting, reported that Mr. W. E. Dean (the Secretary of the Company) had written saying the Directors had been advised by eminent Counsel that, owing to the order prohibiting public lighting, the contract between the Council and the Company was dissolved. The only outstanding matter awaiting settlement was the amount to be paid by the Council down to the date of the order for extinction. The Committee recommended that a cheque be sent to the Company for £30 for gas supplied to May last, accompanied by a letter stating that they did not admit the contention that the contract was dissolved, but holding that it was merely suspended until the order was revoked. The payment was therefore made without prejudice to any other question between the Council and the Company arising out of the contract.

Municipal Undertakings and the Excess Profits Duty.—It was stated at a meeting of the Manchester Corporation Parliamentary Sub-Committee that they had had under consideration that portion of the Finance Bill dealing with the excess profits duty, and had adopted a resolution expressing the opinion that enterprises owned and carried on by municipal authorities should be excluded from the operation of the Bill; "and if for sufficient reason that is considered undesirable, then alternatively that the several undertakings of a municipal corporation should be consolidated and treated as one trade or business—the excess profit duty being charged on the total profits after deducting the total losses." Setting out the average profits of the best two pre-war trade periods, and comparing these with the returns in respect of 1915, it was shown that the excess items for this year equalled £15,493, and the decreases £134,195—thus showing a net falling off, as compared with the average of the best two pre-war trade years, of £118,702.

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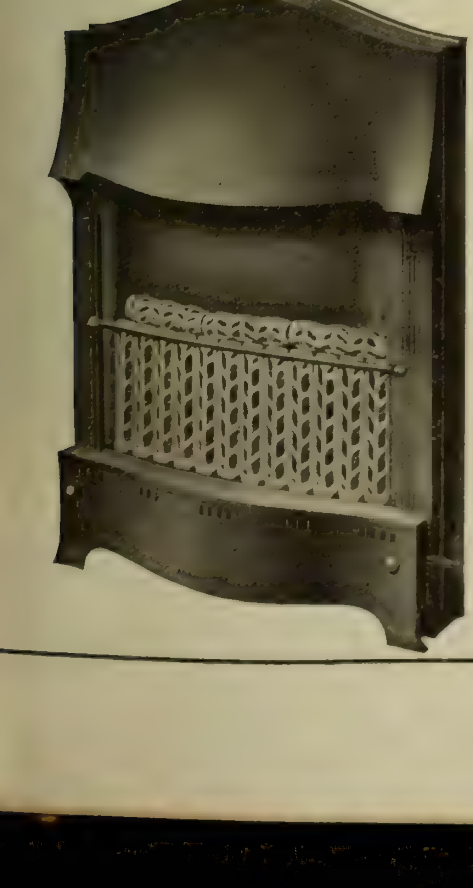

A well-known Medical Man writes:—

"The 'GNOME' throws out more heat
"in proportion to the amount of Gas con-
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"on account of the ventilating flue in
"front is quite unobjectionable even in a
"room occupied all day and all night.
"**It is a most valuable innovation.**"

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ACME WORKS.
BIRMINGHAM.

Quality of Burnley Gas.

At the meeting of the Burnley Town Council last Wednesday, there were numerous complaints about the quality of the gas supplied, and the insufficient lighting of the street-lamps. Alderman Emmott (the Chairman of the Gas Committee) acknowledged that complaints were regularly being made, and that they were likely to continue having them. The Government were asking them to do "certain things" with the gas; and this brought down the illuminating power to some extent. By doing this, they also had greater trouble with naphthalene in the pipes. He admitted the gas was not as good as they would like it; but he believed they all wanted to help the Government in the war, and to do this they could not make the same quality of gas as usual. He advised householders to regulate their incandescent burners, and to ask for a gas employee to attend to their cookers when out of order. It was also difficult to get coal; but they were doing their best, and would have to put up with it. This explanation seemed to amply satisfy the critics.

◆

Increase in Price at Wallsend.—The Walker and Wallsend Union Gas Company intimate that after the completion of the December meter readings the price of gas will be increased from 2s. 5d. to 2s. 7d. per 1000 cubic feet.

A Leaky Gas-Pipe at Bargoed.—Evidence given at an inquest on a Bargoed miner, showed that deceased was found in bed frothing at the mouth and blue about the lips; the room being full of gas. The man's father and other relatives had smelt gas escaping in the house the previous week, and notified the Rhymney and Aber Valleys Gas Company of the leakage. The Company's officials made an inspection, and opened up the main. It was proved by an employee of the Gas Company that there was a leakage in an old pipe in front of the house which had been laid over thirty years ago; and it was concluded that the escaping gas went into the house. No gas was used in the house. A doctor said deceased died in consequence of inhaling coal gas, causing bronchitis, which eventually developed into pneumonia. A verdict to this effect was returned.

Colchester Gas Bill.—A Special Committee has been appointed by the Colchester Town Council to consider the proposals contained in the Bill which the Gas Company are promoting. In moving that such a Committee be appointed, Mr. Potter, while disclaiming any hostility to the Company, remarked that the undertaking was a monopoly, and that the question of the supply of gas on equitable terms was of great importance to the town. He criticized at some length the clauses of the Bill. Alderman Benham said he was sure everyone would agree that the proper course was to appoint a Committee to watch the interests of the Corporation. He was rather sorry that Mr. Potter, with the limited knowledge at his disposal, had made certain remarks which showed that he was not fully conversant with the proposals of the Company. Nothing would be done to at all prejudice the interests of the consumers.

Darlington Loan Sanctioned.—The Darlington Corporation have received the sanction of the Local Government Board to the borrowing of £6807 for purifiers and a station-meter at the gas-works, and £393 for mains, to be repaid within periods not exceeding twenty years and thirty years respectively.

Suicide by Gas.—In the course of an inquest at West Hartlepool, on the body of Ellen Sanders, the wife of a labourer, it was stated that since receiving the news of her son's death at the front she had been always upset. One day last week, her husband found her dead with her head and shoulders on the kitchen table. A gas-pipe attached to a small bracket had dropped by her side. The Jury returned a verdict of "Suicide during mental depression due to grief."

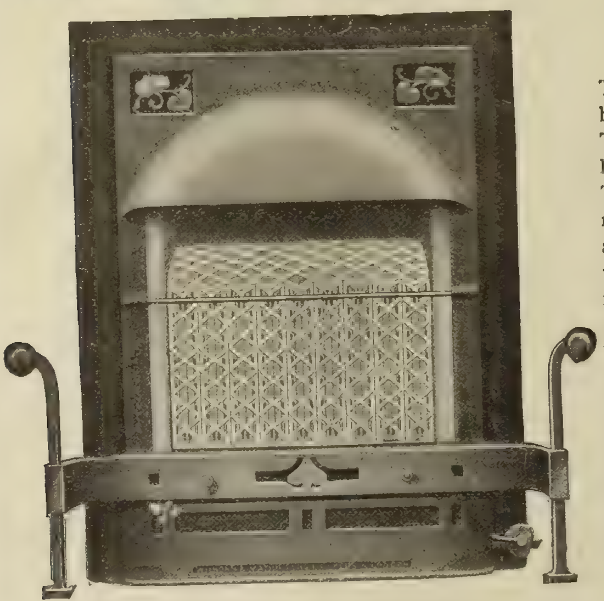
Water Supply of Buenos Ayres.—The report of the Province of Buenos Ayres Water-Works Company for the year ended June 30 states that the profit amounted to £33,317 (against £30,654); and the balance brought forward was £5644. The Directors recommend a final dividend on the ordinary "A" shares of 4 per cent. actual for the six months ended June 30; and out of the balance of £20,700 the contribution to the amortization account is £5000. The reserve account is credited with £1000; there is written off expenses of issues of capital £4000; and the balance carried forward is £8261.

South Metropolitan Co-Partnership Accounts.—The current issue of the "Co-Partnership Journal" of the South Metropolitan Gas Company contains the co-partnership accounts for the year ended June 30 last. These show that the withdrawable bonus for the twelve months amounted to £18,172, and the trust bonus, for the purchase of stock, to £18,588. A statement covering the period from the start of the scheme in 1889 to June last indicates that the total bonus has reached £728,358; and the total cash savings, in addition, £242,487. There has been a sum of £268,589 voluntarily placed in stock, in addition to withdrawable bonus put direct to trust account. The amount transferred from the withdrawable account to the trust account for stock is £213,378; and to this is added the portion of the bonus credited to the trust account (£363,771), and savings and interest, making the total receipts on this account £627,163.

Exeter Public Lighting Contract.—The Lighting Committee of the Exeter City Council reported, at their meeting last month, that they had gone carefully into the question of the charges to be made by the Gas Company in view of the reduction of lighting. The existing contract covered not only the cost of lighting, but the painting, cleaning, and other maintenance of the lamps; and it was pointed out by the Company that the contract price had been arrived at on the assumption that the full number of lamps would be lit, and that all capital charges would continue. The Company offered to allow from the charge per lamp the saving effected by the reduced lighting. This would mean a reduction in respect of the unlit lamps of an annual sum varying from £1 3s. 6d. to £3 16s. 6d. per lamp, extinguished or reduced. The Committee recommended this as an equitable arrangement; and the Council adopted it.

AT THE FRONT OF ALL OTHERS.

WILSON PATENT "SOLA" GAS FIRES.



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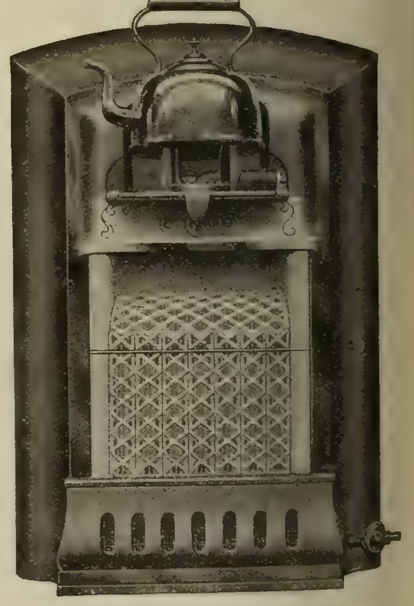
The Fires that solved the problem of SILENT, HIGH-TEMPERATURE, Gas-heating and Radiant energy.
The Fires that raise the room temperature quickly, and are capable of use over a wide range of adjustment to meet our varied weather conditions.
The Fires that are unsurpassed for their HYGIENIC qualities of perfect heating and ventilating. The atmosphere of the apartment is changed without lowering the temperature or creating draughts.



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Gas Cheaper than Coal.—A post-card is being sent by the Southend as Company (of which Mr. C. S. Shapley has recently been ap- ointed Engineer and Manager) to all householders in their area, call- g attention to the fact that "Gas is Cheaper than Coal." People are ged to practise war time economy by using gas for cooking, and to ve labour by employing gas-fires. It is pointed out that saving in pense is effected by using gas in preference to coal at its present high ice, and that Southend gas is the same price to-day as it was before e war. The Company offer expert advice to all who desire it in re- ect to cookers and fires.

Road Repairs and Openings for Mains.—Referring to difficulties ich are sometimes experienced over the breaking-up of roads, owing the fact that gas, water, and electricity supplies are under different ntrol, which prevents the doing of necessary work in each case at the ne time, the "Autocar" says that similar trouble has been experi- ced in the United States, in one part of which—Manhattan—the horities are making an attempt to cope with it. The plan adopted hat, when it is proposed to pave or re-pave a thoroughfare, a notice exhibited prominently in the particular road or street stating that reet openings required for water, steam, gas, or electricity should made at once, as this street is about to be paved, and no pavement will be allowed for one year."

A Leaving Certificate Refused.—An application was made to the nitions Tribunal at Newcastle-on-Tyne, by Arthur Woodcock, an ployee of the South Shields Gas Company, for a leaving certificate, the ground of his having obtained a better position with the local Operative Society. He was receiving only 24s. a week at the gas- ks, while his new employers were giving him 37s. 6d. a week, with romise of 40s. Mr. T. H. Duxbury, the Gas Company's Engineer, ed that they were engaged on munitions work, and could not spare man. As a matter of fact, they were seriously hampered by the rtage of labour. The Chairman remarked that the Co-Operative iety were running very serious risk in taking the man away from Company's employment, seeing that he was a munition worker. certificate was refused.

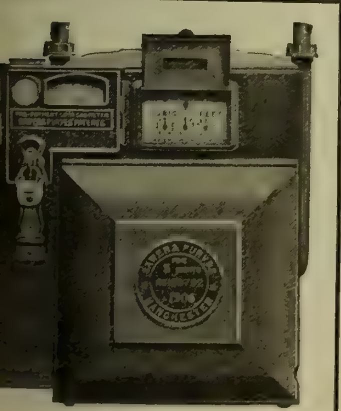
Public Lighting Charges in Reading.—A further reduction in the unt charged for street lighting is being made by the Reading Gas npany. Last August an allowance at the rate of £750 a year was red, and now the Company have added to this another £250, ing a total annual allowance of £1000. This increased allowance be subject to the following conditions: That the Corporation e to extend the period of the existing contract for not less than one and for any period after that one year during which the reduced ting lasts; that the Corporation agree to pay during such extended od or periods the same charge per lamp as they are now paying, ect to any increase or decrease which may be made in the charge equent on any increase or decrease which may be made in the of gas under the terms of the contract; that this offer is made out prejudice to the terms of the contract with the Corporation.

Tests Discontinued at Worthing.—Acting on the suggestion of the Ministry of Munitions, the Finance Committee of the Worthing Town Council have patriotically resolved that tests of the gas shall be discontinued during the war. The matter, of course, arose out of the letter which had been sent by the Ministry to local authorities pointing out that, in the existing circumstances they should do everything in their power to prevent attacks being made on gas undertakings owing to any possible deterioration in the quality of the gas supplied, either by ceasing to test the gas altogether, or at any rate by preventing the results of the tests being made public.

Gas to Replace Electricity in Belfast.—The Belfast City Council have agreed to a proposal to substitute gas for electricity in the central area of the city, with the object of relieving the pressure upon the electricity supply. Dr. Williamson said that, owing to the supply of electricity being short, it was thought, in the interests of the ratepayers, the electric lighting of the streets might for the present be supplanted by gas. Mr. Curley, while admitting that the Gas Committee were able to do lighting much cheaper than could be done by electricity, regretted the sacrifice of the £1500 which the Corporation had spent during the last four years in putting up the electric lamps.

Naphthalene Trouble at Sowerby Bridge.—In common with other districts, the Sowerby Bridge Council have received a letter from the Ministry of Munitions of War requiring makers of gas to scrub their gas in such a manner as the Minister may direct. The letter added that "as Sowerby Bridge are already scrubbing their gas by the 'C' process, this notice is given in order to protect the Council in the event of complaints being made that the quality of gas has deteriorated." At the meeting last week, Mr. J. W. Whiteley said the lights were certainly poorer; but the real cause was naphthalene in the mains. The Council were doing their best to overcome this trouble. He appealed to the public, through the local Press, to bear with the Council in the work they were doing for the good of the country.

Increased Water Consumption in Birmingham.—The "Engineer" reports that, owing to the industrial activity in Birmingham, particularly with regard to munition work, the demand on the resources of the Water Department has been abnormal for some time past. This period of the year is generally the quietest; but the quantity of water now being consumed, for the reason stated, is unusually large. For instance, on Tuesday, the 16th ult., the consumption was 29 million gallons; whereas the supply from the Welsh aqueduct at the maximum is only equal to 25 millions per day. Consequently, the stand-by sources have again been called upon; and the result is that in certain districts the water is harder than is normally the case. The distribution of the mixed water cannot prevail all over the city, as it must be confined to districts where the stand-by sources are connected. Complaints of hardness of the water are likely to be rather frequent until the third pipe is provided for bringing more water from Wales. This third pipe is in contemplation, and but for the war the work would have been commenced last summer.



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Gas and Electrical Publicity Methods.

In the course of an article urging the need for more spirited competition on the part of electrical manufacturers, the "Sanitary Record" asks whether they are putting forth the same efforts as the manufacturers of gas fires, lamps, and fittings, and then proceeds: "We fear not. Those interested in the gas industry are pushing their wares with rare spirit, originality, and enterprise. They are going tooth and nail for their potential buyers—the public—and, by means of advertisements, exhibitions, pamphlets, demonstrations, and lectures, are leaving no stone unturned to bring the virtues of gas lighting, heating, and cooking to their notice. How do the electrical manufacturers stand in this matter? Their announcements rarely appear outside their own trade journals, which municipal officials and the public, for obvious reasons, do not read; and as for exhibitions, demonstrations, and other effective means of publicity, if they do take place, the public knows nothing of them. From whatever point of view one looks at this curious inertia on the part of electrical firms, it seems fairly clear that, in the race for popularity, gas is likely to win all along the line, unless the electrical firms wake up and pursue a wholly different and more enterprising line of action."

Gas Complaints at Tipton.—It was stated by Mr. W. Doughty (the Chairman of the Gas Committee), at a meeting of the Tipton District Council last Tuesday, that the new gas plant was now nearing completion; and he hoped in a few days' time gas better in quality and greater in quantity would be supplied. Mr. Lyons thought the consumers should have a reduction in price under the circumstances. Mr. Powell complained of the constant fluctuations of pressure. Occasionally, he said, the lights went out altogether; and then the gas escaped. Mr. Salter remarked that he had heard many complaints about the gas, and had personally lost considerably through the alterations of pressure.

Gas Troubles at Neath.—Referring to a paragraph published in its pages reporting an unsatisfactory condition of the lighting of Neath, the "South Wales Daily News" say that they learn from Mr. W. C. Jackson (the Gas Manager) that for several months, owing to special conditions of extracting certain bye-products, there has been an inevitable reduction in the illuminating quality of the supply. On the day in question, the water-pipe supplying the retort-house burst, owing to the frost; and this further depreciated the quality of the gas. The reason for extinguishing a portion of the street-lamps has been economy, and has nothing to do with the improvement of the gas supply. The Committee, no less than the Manager, are fully alive to these matters—especially the necessity of dealing with the naphthalene trouble. Plant has been ordered to meet the last-named difficulty; and when this has been delivered and put into operation, Mr. Jackson feels confident the troubles will be at an end.

The City of Leeds have placed an additional order with Messrs. Alder and Mackay, of Edinburgh, for the supply of 500 of their "A. & M." patent pressure-wave automatic controllers.

Among the latest devices suggested to assist pedestrians who are unfortunate enough to find themselves abroad in unfamiliar localities after dark, is a cast-iron illuminated box to lie embedded in the vertical face of the kerb, showing the name of the street.

Mr. H. Claude Classing, of No. 79, Wiltshire Road, Brixton, S.W., has been appointed representative for Great Britain of the General Gas Light Company, Kalamazoo (Mich.), U.S.A., the manufacturers of the "Humphrey" gas lighting specialities.

The Wholesale Fittings Company, Limited, Commercial Street, E., forward a copy of their catalogue for the season 1915-16. Burners, mantles, and sundries are listed; and there are also sections devoted to brackets, pendants, beaded fringes, and glassware (including the "Silchrome" brand of French hard glass).

At a meeting of the Spenborough District Council last week, it was reported that the Council and the Bradford Corporation had agreed to appoint Mr. G. J. Talbot, K.C., as Arbitrator in the matter of the proposed revision of terms for the supply of water in bulk by Bradford to the Spenborough Council's district.

The Ardwick Urban District Council, having been refused sanction by the Local Government Board to borrow money to finance a new water scheme, have decided to proceed with a modified scheme, to cost £1376, which will involve no increase in the rates, but will be paid for out of earned income by economies in other directions.

Reporting on the suggestion of the Ministry of Munitions that councils should do everything in their power to prevent attacks on gas undertakings owing to possible deterioration of the gas supplied, and that this could best be done by ceasing to test gas altogether, or by preventing results of tests being made public, a Committee of the Wandsworth Borough Council say: "We do not think it advisable to discontinue tests altogether, but propose to arrange for fewer tests at a proportionately less cost to the Council."

APPLICATIONS FOR LETTERS PATENT.

16,418.—HELPS, G., "Gas-ovens." Nov. 22.

16,487.—LEIGH, A. G., "Gas-turbine." Nov. 23.

16,497.—GIBBONS BROS., LTD., and MASTERS, R., "Continuous annealing furnaces." Nov. 23.

16,526.—WHITE, A. E., "Coal-gas generating." A communication from the Riter-Conley Manufacturing Company. Nov. 23.

16,577.—M'DOWALL, T. R., "Combined gas fire and cooker." Nov. 24.

16,634.—DAVISON, E. J., and TOOLEY, C. P., "Chequer-bricks of water-gas plants." Nov. 25.

16,673.—TULLY, C. B., "Gas-producers." Nov. 25.

16,696.—DEMPSTER, R. & J., LTD., and BEARD, G. F. H., "Governing-means for gas under pressure." Nov. 26.

16,711.—KEITH, J. & G., "Gas-furnaces." Nov. 26.

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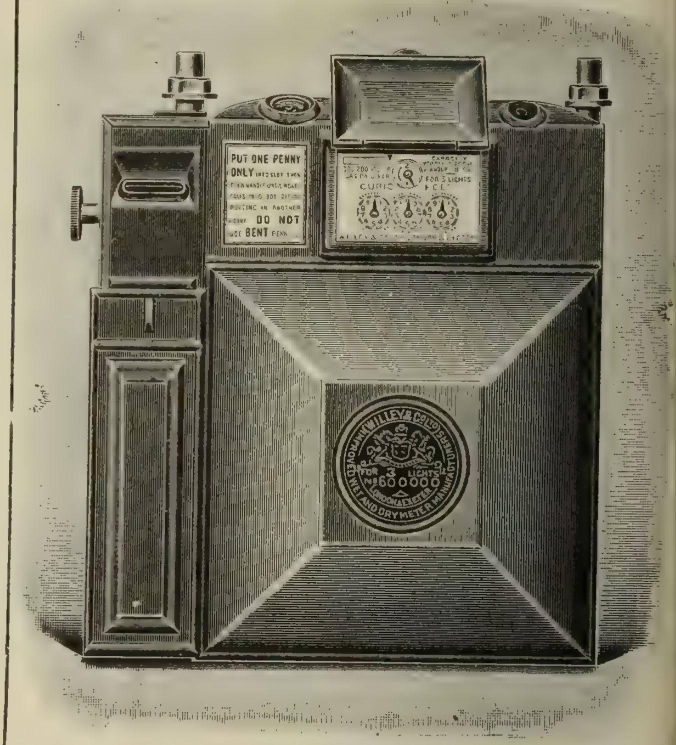

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STOCK MARKET REPORT.

THE Stock Exchange has had a rather slack week, and, on the whole, a duller one than hose we have recently been accustomed to. Various factors, mostly of the usual character, have operated to produce this effect. The considerable advances made in some lines have been followed by realizations to seize profits. This was apparent in Government securities, and conspicuously so in War Loan and Consols; and it is said that a good deal of the proceeds has moved in the direction of the French Loan. The prospectus of this has caught on very well; but, in the opinion of some, there are one or two points which need some further elucidation. Americans were down; and Canadians marched with the market. But in the latter case, the remarkable traffic returns, and the recognized signs of assured prosperity, forbade a continued decline; and before the close they had established firmness. Home Rails were irregular. The Foreign Market was to an extent in similar vein; but Japanese and Chinese in the East, and South Americans in the West, were still attractive. South Africans were unmoved, and showed considerable power. Strong lines were apparent in the Miscellaneous group; the enormous demand for freightage pushed all shipping shares up; rubber recovered from its set-back; and Bank shares were in request. The published accounts of some more undertakings producing warlike material and appliances show big war profits. The Banks are not going to take the projected attack upon their half-commission lying down, and hint at possibilities of retaliation, in which event the assailants might come out losers. Perhaps the whole thing may fizzle out. The early closing at 3 o'clock by the Banks began on Wednesday, and nobody seems to have suffered at present. Business in the Gas Market was a good deal quieter, and presented no very marked feature. Movements—such as they were—were not uniform. Very little was done in Gas Light and Coke. Some issues were wholly untouched; and the ordinary was rather easier. South Metropolitan, though very quiet, was firmer. Imperial Continental made a slight advance to 85. The Money Market was quite easy.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 4, 74⅝, 75, Imperial Continental 77, Liverpool 3¾. On Tuesday, Brighton and Hove "A" 24½, 125¼, Gas Light ordinary 74, 74¾, Imperial Continental 80. On Wednesday, Brighton and Hove "A" 125, 125½, Gas Light ordinary 74, 75, Liverpool 93⅛, South Metropolitan 78½. On Thursday, Brentford debenture 75, 75½, Gas Light ordinary 74, 74⅛, 74½, 4¾, Ilford "B" 99½, 100, Imperial Continental 83¼, 83½, Primitiva preference 3⅝, $3\frac{11}{16}$, Tottenham "B" 96½, 96¾. On Friday, British debenture 72, 72½, Gas Light ordinary 73⅞, 74, 4¼, 74⅜, 74¾, ditto preference 73½, Imperial Continental 83½, 84¼, Primitiva preference 3⅝, San Paulo preference 8¾, South Metropolitan 8, 78½, 79. On Saturday, Gas Light ordinary 4¼, Imperial Continental 85, Primitiva preference $3\frac{11}{16}$.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	..
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd. . . .	5⅛—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c. . .	29—30	5 6 8	
873,480	10	,,	7	7/-	B 7 p.c. .	15—15½	4 10 4	..
95,000	10	,,	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	
147,210	—	—	—	4	Deb. . .	..	—	..
880,000	Stk.	Feb. 26	†14	66/-	Brentford Consolidated	261—266	5 5 3	..
830,000	,,	,,	†11	55/-	Do. New . . .	204—209	5 5 3	..
50,000	,,	,,	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1	
206,250	,,	June 11	4	4	Do. 4 p.c. Deb. .	91—93	4 6 0	75—75½
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	7¾	Do. A Ord. Stk. .	154—159	5 0 8	124½—125½
530,000	10	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	72—72½
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4 6	Do. 4½ p.c. Pref. .	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do. .	103—105	5 1 6	..
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800,000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200,000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11⅓	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk. . . .	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk. .	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord. . .	98—102	4 15 6	73¾—75
2,600,000	,,	,,	3½	3½	3½ p.c. max. .	76—79	4 8 7	..
4,062,235	,,	,,	4	4	4 p.c. Con. Pref.	96—99	4 0 10	73½
4,674,850	,,	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	..
130,000	,,	,,	10	10	10 p.c. Bonds .	..	—	
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7⅝	7¾	Ilford A and C . . .	151—154	5 2 4	..
65,780	,,	,,	6⅜	6¼	Do. B	115—118	5 8 0	99½—100
65,500	,,	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	5 12 6	77—85
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	93⅛—93¼
718,100	,,	,,	7		B	146—148	4 14 7	
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	4/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅔	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B . .	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C . .	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D . .	..	—	..
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	6 13 4	..
499,960	5	June 26	5	2/6	,, 5 p.c. Pref. .	4¾—5	5 0 0	3⅝—3$\frac{11}{16}$
521,600	100	June 2	4	4	,, 4 p.c. Deb. .	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	8¾
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	10	Do. B	222—224	4 9 3	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6	
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	78—79
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref. .	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent. .	..	—	..
137,058	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c. .	135—138	5 8 8	..
742,275	,,	,,	6	6	B 3½ p.c. .	115—117	5 2 7	96½—96¾
181,255	,,	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅝	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅞	63/9	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	5 2 0	
852,000	,,	,,	6½	57/6	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	,,	,,	6⅝	63/9	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p c. Standard Stocks.

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VOL. CXXXII., No. 2744.] TUESDAY, DECEMBER 14, 1915. [67TH YEAR.

EDITORIAL NOTES.

The Unwelcome Naphthalene Revival.

THE revival of the naphthalene trouble as an uncomfortable accompaniment of the introduction of the gas-washing process for the extraction of benzol, toluol, &c., was referred to in the first editorial in the "JOURNAL" for Oct. 26. In a short pithy article given in our columns to-day, Mr. Thomas Glover, of Norwich, discusses the main causes of the fresh appearance, and the methods of obtaining relief from the deposition of the substance. In another article a simple form of petroleum vaporizer is described, which can be promptly introduced, and the effectiveness of which in producing relief is well attested, while the proportion of petroleum required to the gas to be treated is stated to be very moderate indeed.

The discussion of the subject by Mr. Glover reminds of the old difficulties, the old controversies, and the old beliefs and doubts. The best accepted view of former days as to the causes of the formation of naphthalene was that it was due to light charges, high heats, the large vacant space at the top of the retorts, and the exposure of the gaseous products to the radiant heat and the incandescent surfaces. But there were a few who were sceptical as to the validity of this explanation; and yet the proof then lay ready at hand, if anyone had been wise enough to make use of it. Proof is often furnished as to exact causes by the results of producing diametrically opposite conditions. When heavy charges came, when the vacant space at the top of retorts was practically filled up, and when the exposure of the gas to the old deteriorating conditions was reduced, naphthalene troubles ceased, and a distinct difference was found in both tar and gas. As Mr. Glover points out, the tar from light eight-hour charges yielded upon distillation 4 per cent. by volume of light oils; and the naphthalene content of the products of distillation was at the maximum. The tar from heavy twelve-hour charges yields 22½ per cent. of light oils; the naphthalene content of the distillation products being at the minimum. Of course, these percentages are only approximate, and will vary with the character of the coal and the conditions of carbonization; but the two generally stated facts point to several things, and elucidate much that in the old days was somewhat puzzling.

However, even in places where heavy charges are worked, there has been, with the application of the "C" process, a recurrence of naphthalene troubles; and it is greater still where light charges remain the practice. It is clear too that, generally speaking, the trouble has been revived by the constitutional differences in the gas due to the application of the washing process. Though under what may be termed normal conditions—that is to say, if the tar is not supersaturated with naphthalene vapour, and the temperature conditions under which the washing proceeds are right—there should be, and will be, through the washing process, a reduction in the naphthalene content of the gas, still what remains has, with changed temperature conditions, given much trouble. Of course, if the tar used for washing is supersaturated with naphthalene vapour, or the temperature conditions are not correct (as Mr. Glover puts it, the capacity of tar to absorb naphthalene and naphthas increases as the temperature falls, and decreases as the temperature rises), it may well happen that the gas will become more heavily charged with naphthalene than it was before being submitted to the process; and this too would account for current experiences.

However, there is the fact of the deposition of naphthalene, and the return of the old trouble. The question is how to deal with it. Toluol recovery cannot be stayed; it must go on—it is a national necessity—and so the difficulty must be faced in one of two ways, as suggested by Mr. Glover. Either by washing the gas (after the operation of the "C" process) with water-gas tar containing a large proportion of low boiling fractions to reduce the naphthalene, and at the same time compensate for the previous extraction of naphtha vapours, and so prevent deposition, or to vaporize into the gas ordinary petroleum. With the apparatus described in the second article, the use of about 20 gallons of petroleum per million cubic feet of gas is found effective; but the proportion of petroleum can be reduced after the depositions have been cleared from the mains. The subject is a live one at the present time, and to an extent that is not agreeable. But the fact will ensure interest in the contributions appearing in the "JOURNAL" to-day.

Pooling Private Railway Waggons.

THE congestion on the railways and the scarcity of rolling stock under the circumstances of the war have been matters of the deepest concern and difficulty, and have occasioned super-expense, to those engaged in industry—such as gas-works—dependent on the railways for their supplies of raw material and manufactured goods. The congestion and the shortage are largely due to movement of troops, to the ever-increasing transit of munitions and other goods requisite to the prosecution of the war, to the enlistment of railwaymen, and to (good authority asserts) improper organization of available resources. Whatever the causes of indifferent and delayed deliveries, the effects upon industry are uneconomic. Among the proposals for ameliorating the conditions is that of the pooling of private railway waggons. The idea has been raised several times; and now, at a private conference held the other day at the Board of Trade, it appears that a pooling scheme was put forward, including privately owned waggons, as though it had been practically accepted, and was now only awaiting the shaping of the conditions to carry it out—in fact, the scheme, it is stated, has gone so far that it has been decided to pay 6 per cent. on the capital invested, as remuneration for the use of waggons. There is alarm over the situation among private owners of waggons, and protests are falling all round. Of course, in such times as these, one cannot but affirm the general proposition that, where necessary, private interests must be temporarily set aside, if thereby national interests can be served. Colliers, merchant, and other vessels were, in the national interests, commandeered at the beginning of the war and since by the Government, and at their own price. Through the public and shop lighting restrictions, the interests of gas and electricity suppliers have been rightly set on one side in the national interests. The hours during which the sale of alcoholic liquors is permitted have in London and many other areas been reduced—all in the national interests.

Illustration could be extended. But such precedent ought not to govern every proposal that is made. It may be that some things that are put forward for national advantage may bring such mischief in their train that, on balance, they may prove a national disadvantage. We do not say this is so in connection with the question of the pooling of private railway waggons; we should like to hear all sides before arriving at any positive determination. But it does seem to us that there are considerations affecting the proposal that are of such material character that they should be taken into account. One is as to whether the winter is (if this is the intention) a suitable time to introduce a pooling or appropriation scheme for private waggons To introduce it now would dislocate existing arrangements just at the height of greatest pressure. A scheme of the kind should assuredly be carried out at a period when goods traffic is the lightest, and that is in the summer time at any rate, it is so with coal traffic. If the pooling of all privately owned railway waggons is an imperative necessity in the national interests, then, had the scheme been put through last summer, it would have been in working order by now. The Board of Trade recognized quite well months ago that there would be trouble on the railways this coming winter, seeing that they particularly urged large users of coal and even householders to take the precaution of filling their coal stores and cellars. Another point is that many contractors have their own railway waggons; and their current contracts are based upon this ownership, and an exact knowledge as to the cost of delivery. A further point is that it seems wholly unfair that, for example, those gas undertakings that have made provision of railway waggons of their own should suffer so as to benefit other undertakings that enjoy equal circumstances, but have not made like provision. On the other hand, we sympathize with those concerns whose conditions are not such that they could become waggon owners on their own account. A still further point that occurs offhand is that some gas undertakings have had their coal-stores specially built with elevated lines, and they or their contractors have provided (say) twenty-ton railway waggons with bottom discharge in order to facilitate delivery. Unless such works, in any pooling scheme, are assured of waggons that will render them equally good service, they will be at a disadvantage which will not be covered by a 6 per cent. payment on the capital invested in the waggons.

It is evident that the pooling scheme, if there is any real intention of carrying it out—and many important owners of private waggons think such an intention has already taken almost definite shape—requires examining very carefully all round, so that serious injustice shall not be done. The commandeering of colliers is not exactly analogous. All colliers were not commandeered; and the object was the coaling of the nation's Navy. It is proposed to pool all private railway waggons; and the object is the benefit of all and sundry who do not possess waggons of their own, while those whose circumstances permit, and who have been wise enough to become possessed of waggons, will find themselves at a decided disadvantage as participants in a common user.

The foregoing was in type, when, from Mr. J. Ferguson Bell, there was received a letter (which is reproduced in our "Correspondence" columns to-day) in which he urges that all gas undertakings that are interested in this question of private waggon pooling should immediately write a letter to the Secretary of the Railway Department of the Board of Trade, emphatically protesting against the project. As we have said, the present is an exceptional time for goods traffic; but we cannot forget that the question of the sufficiency of railway waggons is not a new one—it anteceded the war by years. The Railway Companies neglected to provide an ample supply of waggons for mineral and other traffic; and the deficiency was largely made up by the expenditure of private capital—for the express purpose of obtaining all the facilities and economies of ownership. The Association of Private Owners of Railway Rolling Stock has a membership possessing between 500,000 and 600,000 waggons; and had it not been for these private waggons, the country would have been, in respect of its goods distributing capacity, in an infinitely worse position than it is at this time of pressure. The country therefore indirectly owes a great deal to the private owners; and it would be poor recompense to deprive them of a convenience of which they are possessed through their own enterprise at a period when the convenience is most urgently needed.

The Defeat of the Kitchen Coal-Range.

ALL practical experience is valuable; and within experience of the kind come the contents of the paper which Mr. W. L. Westbrook, of the North Middlesex Gas Company, read before the London and Southern District Junior Association on Friday last. Not a great while ago, the coal merchants, who were beginning to feel acutely the inroads of gas heating upon their business, and the growing appreciation of the public of the handiness and efficiency of gas methods, circularized London pointing out all sorts of things adverse to the use of gas, and favourable to the continuance of the use of coal, which were egregiously contrary to fact. The clumsy attempt to stop progress, and to set the public against the lessons of practical experience, fell very flat. Nobody heeded what was recognized as a note of alarm by interested persons; and the change from old methods to new continues uninterruptedly. Among domestic heating equipment, the kitchen coal-range is by far the most voracious. Dampers notwithstanding, there is a propensity to so "regulate" them that the fire in the range is constantly on the "roar;" and consequently British thermal units make speedy flight up the chimney, and the waste is enormous. Kitchen ranges, too, are terrible sinners in the contribution they make to intensifying, in residential areas, when conditions are favourable, the murkiness of the atmosphere. It has, however, been admitted by those who make a study of atmospheric conditions that the gas industry has done much in the cause of atmospheric sanitation by what it has effected, through gas cooking, in putting the coal-range out of constant use. At the same time, they are convinced that, while the chimneys of industrial establishments have, despite legislation, a bad reputation as defilers of the atmosphere, the myriads of domestic chimneys in the aggregate far exceed the crime of, and the grime occasioned by, the factory chimney. But though there are occasionally threats that something will be done to bring domestic chimneys under control, there is a decided disinclination, on the part of the powers that be, to intrude upon the prescriptive rights of the householder, though in the exercise of those rights contribution is made to something that is distinctly noxious, and a general nuisance. The fight against the pollution caused by the domestic chimney must therefore continue to be largely a local one, through educational means, through the force of example, and through persistent work on the part of those who have something which can displace heating by coal, without in most operations increasing the cost, and which has the advantages of reducing labour, and of possessing efficiency and the convenience of ever-readiness.

While the gas-cooker has taken a large part in improving matters, unfortunately, standing alone, it does not do all that the kitchen coal-range can do, but with an "efficiency" that is an abomination in the eyes of those who are preaching the gospel of fuel economy. We have therefore alternations of use between the gas-cooker and the kitchen coal-range. But Mr. Westbrook tells us that this is not necessary, and proves the submission by practical experience in the district of the North Middlesex Gas Company—at all events, so far as those people are concerned who can afford to convert their kitchens from coal heating to an entire gas-heating system, and, by doing so, purchase convenience and save labour. What has been done in this respect must weigh with architects, who will find that the attractions of the houses they erect will be augmented by the adoption of a combination gas-heated system in the kitchen, in place of the cumbersome and slow-operating coal-heated range. Where the combination gas system is put into houses as erected, of course the expense is not so great as when a coal-heated range must be removed, its habitation tiled and fitted for the reception of the gas-heated successors, and the necessary gas supplies laid on, and the water-circulating system adapted to the new mode. The kitchen combination adopted in the North Middlesex district consists of cooker, water-circulating boiler with thermostatic control, and a fire for general heating purposes. In two years, the Company have made eleven such installations—four in new houses, and seven in houses from which the coal-ranges have been evicted. In addition, about fifty coal-ranges have been put out of action by fixing a gas-fire in front of the fire-bars, or otherwise sealing-up the front. It is from the experience gained in displacing these coal-ranges, and in installing gas-heated arrangements, that Mr. Westbrook's paper is composed. In it there is information of both technical and commercial value, and actual data as to comparative costs, which should be serviceable to other gas undertakings in prosecuting the work of kitchen conversion from crude to scientific heating methods.

We will pass over the particulars contained in the paper as to the modes of installation, and the limited troubles that have been met with and easily rectified, in order to direct special attention to the comparative financial statements under the *régime* of coal heating and under that of gas heating. Part of the value of these actual and not theoretical figures lies in the fact that they are from houses of varied rental and domestic conditions. Yet they all tell the same tale: That using gas entirely for cooking, the supply of hot water, and heating the kitchen, the costs of the two systems, taking the year through, are extraordinarily proximate, and this without assessing certain financial savings, or taking into account the reduction in the number of servants in the larger houses, and the convenience, the availability, and the comfort which the change has introduced. In making similar comparisons, our electrical competitors succeed in showing savings by taking credit for the wages and "maintenance" of (say) one or two discharged servants;

but Mr. Westbrook has no occasion to do anything of the kind. His comparisons, drawn from actual practical experience, stand favourable to gas as against coal heating without taking credit for any effects external to the work required of the cooker, the circulating-boiler, and the fire. The pulling out of the old range, and preparing and tiling the recess for the new gas-heated tenants, cost from £4 to £5; and, including this and the new appliances and all fitting work, the total cost amounts to £19 14s. If the house is a new one, and there is no pulling-out and alterations to be made, the total cost is a couple of guineas less. These figures, of course, are subject to the described conditions; variations from which may cause differences in cost. If a 3 ft. 6 in. coal-range requires renewing, the cost is something like £10 to £12; and the difference between this and the £19 14s. is, as is shown, money well spent.

Now in comparing working costs, it will be noted that gas is charged at 3s. per 1000 cubic feet; so that where the price is lower in normal times, the financial advantage alone of complete gas heating in the kitchen will be greater, seeing that 30s. per ton is not of late years an uncommon price to pay for a good house coal. Another point which will be remarked is the considerable addition to annual gas consumption that the transfer from coal heating has made. In the smallest house referred to, the increase in the gas account amounted to £3 3s. 11d. in one year after the gas combination was established; but *per contra* 2 tons of coal less were used, which meant £3, and £1 is estimated as the saving in repairs to boiler, and costs of sweep and wood for fire lighting. These two items total to £4; so that 16s. 1d. was actually saved. The succeeding illustrations are drawn from larger property. In the second example, the addition to the gas account was £13 1s. 7d.; but the house was relieved of the dirt and labour occasioned by the delivery and use of 8½ tons of coal, which gave a saving of £12 15s. in the coal bill. The extra cost of gas was therefore 6s. 7d. above the coal bill, without taking credit for the savings in boiler repairs, sweep, wood, &c. In this instance, two servants have been dispensed with since the gas combination was installed; and this represents a considerable gain in the household economy. It is only fair, however, to say that the gas combination has been under constant supervision, while there was extravagance in the use of coal when servants were in full control. Passing to the fourth example in the paper, the testimony there to the capacity of gas for effecting economy is remarkable. In this case, the house has been converted wholly to gas heating. The extra payment for gas amounted to £15 7s. 5d. a year; while in 1913, the quantity of coal used cost £24. The difference between these two figures, representing saving, is £8 12s. 7d.; and this without taking credit for boiler repairs, sweep, and wood, and the wages and maintenance of two servants for whom sufficient employment could not be found. This householder also obtained the full discount allowed by the Company under special circumstances—that is to say, where gas is used exclusively for hot water supply and cooking, a discount of 10 per cent. is granted, and, where gas-fires are also fixed in every grate, the discount is 15 per cent. It was therefore the latter discount that he enjoyed.

Here we have merely extracted a few salient figures from the many given by Mr. Westbrook; but, from the quoted few, it will be seen that the adoption of a complete gas-heated system in the kitchen produces excellent mutual advantages for gas company and consumer. The paper will, we are sure, act as an incentive to similar work being taken up in other residential areas.

The "Journal" and the Sliding-Scale.

After the unswerving and strong support accorded by the "Journal" to the sliding-scale of price and dividend as a healthy and fair method of regulating the conditions of gas supply as between consumers and gas companies, it is interesting, and almost amusing, to have Mr. Charles Hunt, in the year 1915—forty years after the birth of the sliding-scale in its application to gas supply—making the following remarks regarding our attitude towards it in that celebrated year for the gas industry, 1875. "The 'Journal of Gas "Lighting,'" he writes, "designated him [Mr. George "Livesey] Mr. Forster's 'guide, philosopher, and friend'—"words which, although they *may have been* 'wrote sarcastic' "—for the 'Journal' was strongly opposed to the innova-"tion of the sliding-scale—could hardly have been far from "the truth." The validity of the insinuations that some of the words quoted may have been "wrote sarcastic" and that the "Journal" was "strongly opposed" to the innovation of the sliding-scale, can only be tested by the general lines of the comments, and by the literal meaning of the words then used, as the writer of the criticisms of those days is beyond the pale of personal reference.

In considering the attitude of the "Journal" in those days, the conditions of the times as affecting gas companies should be taken into account; and, reading to-day the editorial remarks, it is quite clear they were more directed against the terms of the sliding-scale as applying generally to the conditions of those times than against the "innova-"tion." The fixed initial price proposed in 1875 was the point that aroused the so-called strong hostility; and, in connection with it, the "Journal" proposed what has since been adopted by some undertakings—a neutral zone of price and dividend. Let us quote from an editorial published on June 8, 1875, for the double purpose of refreshing Mr. Hunt's memory, and of clearing away any notion that his published statement may have spread that there was at one time a sort of ferocious antagonism on our part to the sliding-scale, which has since operated so beneficially for both gas consumers and gas suppliers:

> The initial price is indeed a most important matter. We are not legislating for to-day; but, let us hope, for years to come. The price of 3s. 9d. *may be sufficient for to-day*, but who can guarantee us against a recurrence of the events of the past three years. We reiterate our opinion that 3s. 9d. is *an utterly insufficient price*, if the companies are to be fined for exceeding it. The question of initial price is really the cardinal point in the Bill. The Board of Trade, adopting our suggestion of an up-and-down sliding-scale, plainly propose the price of the Act of 1860 as the initial price. We have before proposed this price; and we now suggest that the downward scale of dividend should not commence until 4s. 6d. be exceeded, and that the upward scale should not begin unless the price is less than 3s. We believe this would be fair to all the companies, and would place them all pretty nearly on an equality.

Does this look like any intention of being strongly opposed to the "innovation of the sliding-scale?" A week later, in an editorial, we have these words:

> We gather from the speech of Sir E. Beckett that the "associated companies" object to any sort of sliding-scale of dividend; and so, in fact, do we. We only support the up-and-down scale as a simple measure of fairness. If a company are to be fined, for that is what it practically comes to, when they exceed one price, it is but just that they should be rewarded when they make another and lower charge.

In other issues, the editorial references all indicate that, so far as the "Journal" was concerned, the conditions—particularly that as to the initial price—were the ground of antagonism, and not the principle of the sliding-scale. It was "supported" as "a simple measure of fairness." There is a great deal of difference between opposition to a principle, and opposition to the conditions that may be applied in the exercise of the principle.

Now we are wondering why it is Mr. Charles Hunt has seen fit in December, 1915, after the long loyalty of the "Journal" to the principle of the sliding-scale, to suggest that at one time we were "strongly opposed" to it. Perhaps he will now try to reconcile the statements we have brought to light from the past with his own deliberate assertion to-day. The unqualified charge does not in any way harm us; our only care is historical accuracy.

A Great Labour Combine.

A step was taken last week which creates the greatest labour combine that this country has ever known, and the power of which for mischief to the national interests is beyond estimate. The Executives of the Miners' Federation of Great Britain, the National Union of Railwaymen, and the National Transport Workers' Federation, adopted a scheme by which these three powerful bodies agree, under certain conditions, to throw their combined weight into offensive and defensive movements in the interests of wages and the conditions of labour in the coal-mining and carrying industries. By the rules that were agreed to, it is, among other things, provided that matters submitted to the joint body, and on which action may be taken, should be those of a national character, or vitally affecting a principle which, in the opinion of the executive making the request, necessitates combined action. Then it is arranged that co-operation of the joint organization shall not be called for until the matter in dispute has been considered by, and received the endorsement of, the national executive of the organization primarily concerned, and any of the organizations instituting a movement likely to involve the other affiliated organizations is, before any definite steps are taken, to submit the whole matter to the joint body for consideration. But joint action can only be taken when the question at issue has been before the members of the three organizations, and decided by such methods as the constitution of each organization provides, after which a conference is to be called without delay to decide and consider the question of taking action. It is believed by the unions concerned that this alliance will prove the most effective weapon, when peace is restored, for defending existing wages, and maintaining the war bonus, which it is considered should be made a permanent addition to wages. It looks as though when international peace comes, there are likely to be troublous times at home with labour; and in what happens this new and powerful combine will take a leading part.

The Safety of Miners.

As the result of their extensive researches, the Explosions in Mines Committee some time ago arrived at the conclusion that the use, in specified quantities and in a suitable manner, of incombustible dust will greatly diminish the number of explosions in mines, and limit their violence, though the experiments do not permit the Committee to say that the treatment will render such explosions impossible. But having decided that the use of incombustible dust would be beneficial from one point of view, the Committee found themselves faced with the question of whether the scattering of considerable quantities of fine dust in a mine might not prove dangerous to the health of persons engaged in work there. The elucidation of this part of the subject was entrusted to Dr. J. S. Haldane, F.R.S., whose conclusions are embodied in the recently issued seventh report of the Committee. The preceding six reports were devoted to experiments, already referred to, upon the effects of inert dust in preventing or limiting explosions. The dust of free silica has long been known to be more or less dangerous; but the result of Dr. Haldane's investigation is to fully confirm the conclusion already arrived at by Professor Beattie, that dust of argillaceous shale, such as is found interstratified in the coal measures in most mines of the United Kingdom, though it contains silica, is not in the least likely to prove a danger to health. On the other hand, he finds ground for suspecting that flue dust—also being employed for stone-dusting in coal mines—may have injurious effects; and he advises that its use should be discontinued. The report shows that the researches have been carried out in a manner which fully justifies acceptance of the statements that, both from human experience in coal mines and from experiments on animals, there is clear evidence that shale dust when inhaled is no more deleterious than coal dust; but that it is desirable, from the point of view of health, to reduce as far as practicable the inhalation of any kind of dust in mines. In connection, however, with the discussion of this question of safety in mines, it may be pointed out that the very first table in the report proves, as Dr. Haldane says, that coal-mining is at present one of the relatively healthy occupations.

Companies of Enemy Character.

Those who have concerned themselves with what is undoubtedly a very difficult problem on the industrial side of the war, will have noticed that a Bill has been introduced into the House of Lords by the Earl of Halsbury, with the object of making provision with respect to companies of enemy character; and they will probably also have seen, many with regret, that on the occasion of the second reading of the measure, the Lord Chancellor, while expressing agreement with its principle, said he feared there was little prospect of the Bill becoming law. Its intention is to provide that, where it shall appear to the Attorney-General that any company registered in the United Kingdom is, owing to the character of its directors or shareholders, or to any other cause, of a predominating enemy character, he shall present a petition to His Majesty in Council praying that it may be declared to be an enemy company. Any officer or shareholder of the company, not being an enemy, may raise an objection, and be heard before the Judicial Committee of the Privy Council; and if the Judicial Committee shall report that the company is of a predominating enemy character, it may be declared to be an enemy company, "and any ship belonging to such company shall forthwith become the property of His Majesty the King." Such a company shall during the present war be deemed to be an enemy; and all such disabilities and other consequences, whether at common law or under any Royal Proclamation or Statute, shall attach to the company and its property and dealings, as if it were a company incorporated and carrying on business in an enemy country. The name of the company shall not be removed from the register; but it shall be notified therein that the concern has been declared an enemy company. All branches of an enemy company shall be treated as of an enemy character, and all transactions by or with any such branch as transactions by or with an enemy. On the reading of the Bill a second time in the Upper House, the Lord Chancellor admitted that the majority of the Court of Appeal have decided that, if seven or more people, all enemy aliens, have joined themselves together and incorporated a company in this country, they have by that means created an entity which is not German in its character. As, however, the case in which this judgment was given is to be carried to the House of Lords, he suggested that the Bill might be held-up pending the result of the appeal.

OBITUARY.

The death occurred last Tuesday, at the age of 64 years, of Mr. David Wood, the Secretary and Manager of the East Hull Gas Company. Deceased was the oldest servant of the Company, having been in their employment for 38 years. He leaves a widow and two daughters.

In connection with electricity, Mr. Thomas Parker, who died at Ironbridge on the 5th inst., had many successes to his credit; but so far as the gas industry is concerned, he was less fortunate. Born in 1843, he began work at a very early age at Coalbrookdale, and in 1882, in partnership with Mr. P. B. Elwell, established an accumulator and dynamo business in Wolverhampton. Subsequently, he did much work in electric traction; his principal scheme being the electrification of the Metropolitan Railway. His inventions were numerous, and not confined to one field. In 1880, he obtained a medal at the London Smoke Abatement Exhibition for one of the first slow-combustion stoves introduced. Then came the patents—which, unfortunately, so many investors have had cause to regret ever having become acquainted with—for the production of "Coalite," by the partial distillation of coal at a low temperature. The controversy which the proposals aroused must be still fresh in the minds of most gas men.

PERSONAL.

Consequent upon the death of Mr. C. W. Boyns, the Secretary and Manager of the Romford Gas Company, Limited, Mr. J. C. Wright (the Engineer) has been appointed Engineer and Manager; Mr. George Berridge (at present Accountant and Assistant Secretary at the Kettering Gas-Works) has been selected to fill the position of Secretary; and Mr. D. Hayes (who has for the past ten years been with the Romford Company) is promoted to the post of Assistant Secretary.

By a mutual arrangement, Mr. E. J. Wellens has been able earlier than was expected to leave Hebden Bridge and take up his new post as the Works Manager at the Grimesthorpe station of the Sheffield Gas Company. His successor at Hebden Bridge, Mr. T. H. Nield, has also "got into harness." Before Mr. Wellens left, the workmen at Hebden Bridge presented him with a neat silver spirit kettle, appropriately inscribed. At this pleasing ceremony Mr. Nield presided; and the gift was handed over by Mr. W. Wilkinson, the oldest employee on the works.

Mr. Alexander's Retirement.—In the "Journal" for Nov. 30 p. 477, reference was made to the retirement of Mr. Alfred J Alexander from the secretaryship of the Bristol Water-Works Company (after having occupied the position for upwards of 40 years) and his acceptance of a seat on the Board. The "Bristo Times and Mirror" referring to the matter remarks: "This is an announcement of peculiar interest, for Mr. Alexander is one o the best-known men in Bristol, and his services to the Water Company as Secretary and General Manager have been not only of remarkable length, but of inestimable value. Mr. Alexander has seen the Company grow to its present splendid position as one of the first water companies in the country; and he has done much to promote the development. It is no secret that the success of his work brought him years ago tempting offers from other large water companies. Mr. Alexander combines in a happy way exceptional business capacity with perfect courtesy His co-Directors and the shareholders generally are to be congratulated on the fact that his knowledge and ability are retained by his acceptance of a seat on the Board."

The December issue of "A Thousand-and-One Uses fo Gas" (published by the British Commercial Gas Association) i a wholesale drapers' number, and contains special articles upon gas appliances in the textile trades, gas in the textile factorie of Bradford, and the effect of gas lighting on coloured fabrics.

ELECTRICITY SUPPLY MEMORANDA.

Lighting of Artizan Dwellings.

The lighting of workmen's dwellings has the same attraction for some electricians as a light has for moths; but like the moths several electricians have seriously "singed their wings" over the schemes they have adopted. Many trials have had to be scrapped; or, if not scrapped, they have not led to an extension of permanent business. With all the distortion of figures, electricians cannot get away from the fact that the consumer who in the scale of opulence is located at the bottom, cannot have the same illumination from electricity as from gas for a given price, if the price is one showing a real profit to the undertaking. Moreover, it is not lighting only that the working-class consumer needs to get through his gas-meter. He has realized that he lives in a labour-saving age; and although his trade union may object to labour-saving machinery on the works or in the factory, the working man does not object to the introduction of labour-saving and convenient appliances into his home. He therefore wants his gas-cooker or his gas-ring and griller; and he likes the idea of a mono-supply for lighting, baking, grilling, and boiling, all through one meter. There is a convenience in this to the man of limited means; and with this convenience the electricity industry realizes its incapacity to economically supply him. There is the Fixed Price Light Company. That piece of enterprise does not appear to be doing anything very startling, judging by the rare mention that is made of the Company and its work. We do not remember that the accounts of the Company have ever been published in the electrical papers; and how the shareholders are faring is a matter known only to those interested in the concern, and those who are favoured by their confidence. The "Electrician" has been trying in an editorial to boost-up the subject of the lighting of artizan dwellings. An article in its columns by Mr. J. Cleary on an experience at Brighton has called the editorial pen into action. It is pointed out that the metallic filament lamp has altered the conditions, and made a lighting supply practicable, for workmen's cottages and flats. In the days of the carbon filament lamp, the extra charge that had to be made for "free" installation supplies turned the electric light into a veritable luxury. Now the lower consumption metallic filament lamps have altered the position of affairs. The amount of energy used is so much less that, it is said, a substantial additional charge can be made for the installation, and, even so, says the Electrical Editor, the cost of electric lighting will compare favourably with the cost of gas lighting. We should like to be associated with the Editor of our contemporary in a running test, with meters and photometers, if he chooses to take it on, and will publish the result in his paper—the same as we shall be pleased to do.

Gas and Redecorations.

According to Mr. Cleary, the gas industry is in for a very bad time if every electrical engineer does his duty. He writes: "Until such facilities are given that the electric light may find its way into the house of every artizan, it cannot be said that the electrical engineer has fulfilled his mission." So that, when this mission has been fulfilled, the gas industry will find itself without any lighting business. Mr. John Christie, of Brighton, it appears from the article, has started on this mission by supplying electric light to a number of artizan dwellings and flats—very properly the property of the Corporation; and the experiences with this work supply Mr. Cleary with the material for his article. The reason assigned for making the change in the lighting has to do with redecoration. Mr. Cleary makes some statements concerning the wickedness of gas in respect of the destruction of decorations, the impeccability of the electric light, and the fearful cost that gas occasions, as though houses never require redecorating through other causes than gas lighting. He says that the owners of small property are kindly disposed to the change to electric lighting, as they now realize that by this means, they can "overcome" the annual tax of about 20 per cent. upon the revenue of their property for redecorating. Then, again, Mr. Cleary loosely tells us that an estate agent dealing in weekly properties, whose payments for redecorating due to gas discoloration, "&c.," amounted to upwards of £2000 per annum, has found a remedy in the electric light. We are not told what the "&c." covers. Then a couple of years ago the Health Committee of the Brighton Corporation, in their annual report, stated

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THE "JOURNAL" SUBSCRIPTION RATE AND NATIONAL FINANCE.

Until the Budget was presented last September, it had never occurred to us that national fiscal conditions would interfere with the subscription rates that have existed for the "Journal" over the long period of 42 years. But what was never contemplated, nor even dreamed of, has come to pass. Under the Post Office and Telegraph Act, 1915, which became operative on Nov. 1, what we must confess has been a low rate of postage within the United Kingdom for a paper such as the "Journal" has been revised (with, of course, the object of increasing the country's revenue from this source); and now the cost of transmission through the post is to be ½d. for every six ounces, or part of six ounces. Under the circumstances, unless the "Journal" was reduced to a skeleton of its own self, by diminishing the quality of the paper (which would make it less suitable for binding and preservation), and unless the articles, reports of meetings, and the general intelligence were cut down to a length which would seriously detract from the reputation enjoyed for completeness of record of the affairs of the gas industry over the past sixty-seven years, it would be impossible to bring it within the weight which can, under the new order of things for newspapers, pass through the post at ½d.

Simultaneously with the increase in the rate of postage, the cost of paper and printing has (as in the case of all other commodities and work) been seriously augmented. This, even without the additional postage, might be a reason for reducing quality in order to economize. But there is no intention of taking any such course, nor, on account of the extra cost of production, of asking for an increase of subscription. But it is only fair that subscribers should share the burden of extra costs by paying the additional postage; and we are perfectly certain no one will object to this. The extra postage, assuming all issues were of normal size, would be 2s. 2d. a year; but there are occasionally numbers that exceed even 12 oz. in weight, and the postage of which will cost more than 1d.—for instance, the transmission from office to home subscriber of the Institution number for 1914 would, under the new postal charges, have cost 3d. per copy. Under the circumstances, we are adding 2s. 6d. to the prepaid annual subscription—making it 23s. 6d., and to subscribers who prefer making prepayment half-yearly, the rate will be 12s.

No apology is needed for a change in the terms of subscription brought about by a cause over which we have no control. But there are one or two interesting points that the alteration brings to mind. As already mentioned, the prepaid subscription of £1 1s. has been continued through the long period of 42 years—in fact, ever since the "Journal" was first issued weekly at the price of 6d. per copy. Prior to that (from 1849), the prices varied per copy from 1s. to 1s. 6d. for first quarterly and then monthly issues, and later fortnightly numbers. In the sixties, 8d. per copy was the charge, with variations upwards for special numbers or issues containing supplements. When 6d. per copy and £1 1s. as the prepaid subscription were first charged, the size of a weekly issue ranged between 32 and 40 pages, and this without a wrapper, and, after the manner of the times, unstitched and uncut. But for years before the war, the size of our normal weekly issues had grown to from 64 to 72 pages, which growth was entirely due to the greatly extended interests of the gas industry, and the more complete record maintained of its affairs—technically, commercially, and geographically. With all this enlargement of information and therefore of value, combined with the additional expense of production, the price of the "Journal" was continued at 6d., and the prepaid subscription at £1 1s.—the subscription, including postage, only representing 4·8d. per copy, as against the 6d. charged for single copies. With the new rate of prepaid subscription—£1 3s. 6d. per annum—the subscriber will obtain his copy weekly (including the higher postage) for less than 5½d.; so that the subscription rate will still be below the charge for a single copy, which is an unusual condition with technical and trade papers.

that the cost of redecorating, "&c.," in the artizans' dwellings administered by them was absorbing more than one-third of the rent, and even this amount was inadequate to keep pace with the deterioration which was largely due to gas, and it was found impossible to keep the houses clean. Now is not all this, as stated, pure exaggeration? If houses are fitted with incandescent gas-burners, there is no reason why there should be the need for redecoration any sooner than the conditions necessitate for health reasons. Anyone who has had any connection with the upkeep of cottage property knows full well that neither the 20 per cent., nor the £2000, nor the one-third of the rent of the artizans' dwellings, represents expenditure due to gas lighting. The "decoration" of houses occupied by the artizan classes is always liable to depreciate at a quicker rate than that of houses tenanted by persons of different occupations and different habits; and health demands that the insides of such houses shall receive somewhat frequent attention. The cost, too, of painting and keeping in repair the exterior of such dwellings is not light, but it is very necessary work. It is folly therefore to pretend that gas is primarily responsible for the cost of the upkeep of houses and maintaining them in sanitary condition. The writer has rooms in which bijou and medium-sized incandescent gas-lights are used, and which run for years without being redecorated; and so he knows, from personal experience, that Mr. Cleary's assertions do not in the amount of insinuation contained in them faithfully represent the truth of the matter, according to the experiences of other people. If Mr. Cleary was referring to the misuse of flat-flame burners (which are often employed in a way which renders combustion incomplete), he should have said so.

Installation and a Question of Lamps.

The methods of installing electric light in these artizan dwellings and flats are not exactly the sort that the Electrical Engineer of Brighton or the Editor of the "Electrician" would have in their own houses, in considering safety, maintenance, and appearance. Lead-covered cables were adopted; and the houses were looped together—the work being carried out inside the houses. Similarly lead-covered wire was used for internal wiring; and thus the cost per point came out at the low price of about 10s. 6d., including "first quality" switches, holders, ceiling roses, and flexibles. The articles specifically mentioned as being "included" do not refer to the slot meters, the cost of which, the "Electrician" says, is about 35 to 40 per cent. of the total expense of a prepayment installation. It is stated that lights are fixed in every room and in the hall; there being six points in the flats and seven points in the houses. Free lamps are also supplied, and are replaced in respect of electrical failures, but not if mechanically broken. The lamps, it appears, are 40-watt ones; so that the tenants of the houses and flats have to be content with a comparatively small amount of light in their rooms. The occupants of artizans' houses will not want many of these lamps to meet with a premature end, seeing that they have not many two and eightpences to spare for lamp replacement. The article tells us that the lives of these lamps were taken at 1000 hours, and it was estimated that there would be only one lamp failure per house per annum, instead of which there were only seven failures the first complete year out of a total of 275 lamps, fixed in 44 houses. But the first year is no criterion as to what will happen in succeeding years; and there is no question, judging from experiences among ordinary electricity users, that the estimated average of one lamp per house per annum will be exceeded in artizans' houses. Mr. Cleary does not say whether there were any lamps that came to an untimely end through causes other than electrical failure, and for which the consumers had to pay. In connection with this point of lamp failure at 2s. 8d. a time, Mr. Cleary makes the silly statement that "if full advantage is taken of this, it will enable us to lead where our rivals dare not follow, as a gas mantle in a gust of wind is like a puff ball reduced to powder." As a rule, there are not "gusts of wind" in dwelling-houses; and, in the writer's own house, he has inverted mantles that have been in service upwards of three years, and they have not been reduced to powder yet, but are yielding exceedingly good service.

Costs, Income, and Profits.

The price charged to the occupants of the dwellings and flats is 6d. a unit, which includes free lamps, slot meters, and free installation; and the average income per house is about 6d. per week, which means that some of the houses use less than a unit, others more. We should like to see a proper balance-sheet drawn up, giving all details of expenditure (including capital charges, maintenance, collection, &c.), together with the income, so that one might be able to judge better than is possible from the meagre information given in Mr. Cleary's article as to how far this cheap installation, low-consumption business is profitable to the Corporation. The "Electrician" says "the result is found financially satisfactory;" and Mr. Cleary says that this class of work "*given favourable conditions*," can be made remunerative. "Given favourable conditions" is an excellent safeguard. The income averages 26s. a year. The fitting-up of a house having seven points, at 10s. 6d., costs £3 13s. 6d. With a slot meter and other expenses, there must be more than £3 13s. 6d. to reckon as capital, the charges upon which have to be defrayed out of the 26s. income. On the £3 13s. 6d. alone, 10 per cent. for interest and depreciation amounts to 7s. 4d. It is not unusual in a house of seven or eight rooms to have to replace (say) three metallic filament lamps after a year's use. At 2s. 8d. each, this amounts to 8s. Maintenance also costs something. If 15s. 4d. represented the total outgoings from the 26s. income, we get 10s. 8d. as the balance for the 52 units, which means 2·46d. per unit. According to Garcke, the ordinary (flat-rate) consumers at Brighton are charged 4½d. and 3½d. per unit—they may be paying more during war time—so that the small consumers in the artizan dwellings appear to be supplied on preferential terms. Supposing 52 units were supplied at 4½d., this would amount to 19s. 6d.; leaving only 6s. 6d. to cover capital, depreciation, maintenance, and all other charges incidental to these installations. We fail to see, on the superficial evidence vouchsafed, how these installations can be called "financially satisfactory" or "remunerative;" and these are good class artizan houses, and not houses such as are occupied by the poorer sections of wage earners. There is another aspect of the matter. Mr. Cleary intimates that both classes of slot-consumer find electricity much cheaper than gas. He also says that there is no doubt that electricity at 6d. per unit can, providing that an installation scheme is introduced, displace gas at 2s. 10d. *plus* rentals, or 3s. 8d. per 1000 cubic feet, with free fittings. Now Mr. Cleary cannot dispute that a unit of electricity will only give a consumer 800 candle-hours, even allowing the best attainable efficiency with ordinary metallic filament lamps of 1 candle per 1·25 watts. With 6d., and gas (including fittings) at 3s. 8d., 136 cubic feet can be purchased; and with inverted burners (the mantles of which last almost an indefinite time), an efficiency of 20 candles per cubic foot is realized. So that the 6d. can purchase 2720 candle-hours, as against a maximum of 800 candle-hours under the scheme described by Mr. Cleary.

Larger Houses, Vision, and Infant Mortality.

Now if 6d. a unit pays with these artizan dwellings and their limited consumption including installation, lamps, maintenance, and all else, a similar scheme ought to pay better still in larger houses. Why not? Of course, we shall be told that an installation and equipment such as is found sufficiently satisfactory for these artizan dwellings and flats would not suit a larger house—in fact, would not be tolerated. The "Electrician" says: "It is essential that the first cost should be kept as low as possible, not merely in the house wiring, but in the services." Besides this, there is another defect in the equipment in these dwellings. The metallic filaments are exposed to the eyes of the occupants; and Mr. W. R. Cooper, speaking at the meeting of the Illuminating Engineering Society the other week, said: "To expose metallic filament lamps directly to the eye was wrong. He sometimes saw them used with clear glass globes, and by people who ought to know better." The Editor of the "Electrician" should impress this upon Mr. Christie in connection with the lighting of the artizan dwellings. The tenants ought to have a nice prismatic dish or globe for each lamp, or direct or semi-indirect lighting should be arranged for. If it is wrong to expose metallic filaments to the eyes of the rich, it is surely wrong to expose them to the eyes of the poor; if it is wrong to expose the filaments to the eyes of the workers in factories, it is wrong to expose the filaments to the eyes of those workers when at home. To wind up, we may as well give Mr. Cleary's final kick at gas: "The only opposition to the introduction of electric light for general use as an illuminant comes from those interested in the sale of gas and gas devices. This must be met and beaten in the interests of the community, as by the introduction of electric light a housing reform will be accomplished which will automatically overcome the great waste now caused by lamps and naked lights, and infant mortality will be reduced, thereby preventing the wastage of human life which the nation can ill afford." From this, it is supposed, we are to understand that among the other evils of gas "infant mortality" and "wastage of human life" must be reckoned. If so, and if Mr. Cleary will look round and note the multitudes of people reared in the world under gaslight and on gas-cooked food, he will see that his words contain something that can be added to the immense accumulation of foolish talk about gas that has emanated from the mouths and pens of electricians.

Electrically Heated Pants.

This is not a joke. It is a real and serious proposition. The German and Austrian armies do not relish winter campaigning and the physical inconvenience to which soldiers of the Central Powers are exposed through cold has, with the view of producing amelioration, been under the consideration of the ingenious Professor Max Beck, of Innsbruck, and Dr. von Schrötter, a Professor of Medicine at Vienna. They have solved the problem, and quite simply, by designing electrically heated pants, the wearers of which would be connected-up in series to the circuit when engaged in trench work. We are indebted to an article in the "Electrical Times" for the information. Wire woven into an asbestos fabric has long been employed for such novelties as electrically warmed carpets, mats, &c., and now the idea has been adapted to the pants heating scheme. For these, strong, supple wires are woven into texture chosen for its insulation properties. It is stated that the wearer of the electrically heated pants can readily connect-up to, or disconnect himself from, the circuit, which is supplied with energy through cables at a distance of 100 yards or so. The cost for current is given as ½d. to 1d. per hour per man; and, as there are twenty-four hours' heating to be done in a day, numerous cold days in winter, and millions of men in the field, the pant-warming scheme would add considerably to the running expenses of the war. The electrically heated articles only weigh 30 oz.; and the initial cost per man is stated to be £3 6s. 8d. to £4 3s. 4d. Then there is the maintenance of the electrical warming "installation." So that, all told, this is an expensive proposition. If the ½d. or 1d. per hour for current represents the cost of a unit of electricity, our contemporary thinks that the supply of 1000 watts to the pants of an enemy soldier for any length of time would be as effective from the Allies' point of view, as a bullet. Besides, the men's lower extremities immersed in mud and water would not conduce to comfortable electrical treatment; and the pants we imagine would be found rather inconvenient with *entente cordiale* bayonets in close proximity. We reckon they would rather impede motion; and the entanglement of connecting-wires at the rear would not facilitate matters, in the disorder that follows the appearance of bayonets or other causes for expediting movement.

COKE AND OTHER MATTERS.

By "Qui Vive."

Sale of Coke in Small Quantities.

How many gas undertakings give poor people the opportunity of buying coke in small quantities at a reasonable price? Some do, it is true; but a great many leave the poor to the mercy of the hawker, who often makes a fabulous percentage profit in selling coke by the "penn'orth." From his point of view it may be fair, for he has a living to make, though in doing so he exacts a huge price per hundredweight or per ton for all his customers buy from him. This is not in the interests of the poor, nor is it to the interest of the market for coke, which is thereby rendered much more expensive than need be the case.

It is not suggested that gas undertakings should engage in the hawking of coke, for it is an unprofitable business; but it is suggested that all possible facilities should be given poor people to come to the works and carry away ¼ cwt. of coke in a sack, barrow, or other receptacle at the actual yard price. This is altogether a better proposition then to sell them ¼ cwt. of coke in an expensive paper bag, costing about ½d., for which they have the pleasure of paying. Further the paper bag has to be filled; while the filling might just as well be done into the receptacle brought for the purpose. The best method is to use a weighing machine fitted with a scoop which will comfortably hold ¼ cwt. of coke, and which is well-designed for filling anything from a sack to a barrow. An old man or boy is quite suitable for such work; and, being a single-handed job, there is an advantage in cost as compared with using paper bags, which can only be filled with the aid of a second person. From every point of view it is preferable, in the writer's opinion, to dispense if possible with the paper bags, which are flimsy and very liable to break, and are soon rendered altogether useless if the coke is wet or if brought into contact with dampness.

To popularize a system of selling coke loose and in small quantities, it might prove feasible to sell ¼ cwt. tickets to shopkeepers in dozen, or even larger, lots, at a discount of (say) 3d. per dozen tickets. In this way much could doubtless be done, and in a manner which should prove a boon to those who could not otherwise afford to buy fuel in the middle of the week. At the present time, when delivering facilities are so much restricted, every possible step has to be taken to induce the actual users of the fuel to remove the coke; and any scheme which has this for its object is at least deserving of consideration. Perhaps readers will be good enough to describe in the columns of the "Journal" any system which they may have adopted with a view to inducing all classes of customers to fetch their coke.

Inducements to Dealers.

Then, n the case of the more well-to-do people, who generally purchase their fuel through the local coal merchant, much may be done by engaging the sympathy of this gentleman in the only possible way that will interest him, and that is by making it more attractive for him to sell coke than coal. When this essential factor has had due attention, the economy, efficiency, and advantages of coke will be put before the public in their proper light. During such times as the present, it cannot be a good policy to attempt to cut down the man with the horses, vans, and what is more important, the labour to work them, to the minimum tonnage rate; for, on the one hand, expenses are exceedingly heavy, while, on the other hand, coke is fetching high prices. The best policy is undoubtedly to offer liberal rates, and in this way secure the vans for the cartage of coke in preference to coal.

It must, of course, not be forgotten that rates of discount, when expressed in percentage figures, operate very greatly to the advantage of the dealer when prices are high, for a 10 per cent. discount on coke when it is priced at 25s. per ton is 2s. 6d. as compared with 1s. 6d. when the price is 15s., though the tonnage to be handled is virtually the same. On the other hand, discounts, when expressed in a definite rebate per ton, give the dealer the same terms whether the price be high or low. It is a moot point as to which is the better system, and arguments can be advanced in favour of both methods, varying with the circumstances existing at the time.

NAPHTHALENE AND GAS WASHING.

By Thomas Glover, of Norwich.

In the "Journal" for Oct. 26, allusion was made to this subject in the first editorial article; and a little discussion of the point is appropriate, and may be useful, under present circumstances.

The question as to whether the naphthalene content of gas is increased or decreased by working the "C" process, depends principally upon three factors.

(1) The naphthalene content of the tar used as the washing medium.

(2) The proportion of light hydrocarbon vapours to the vapour of naphthalene present in the gaseous products of carbonization.

(3) The temperature conditions under which the washing process is conducted.

With regard to the first factor, the naphthalene content of the tar will depend primarily upon the conditions under which the coal is carbonized; small charges and high heats, with exposure of the gaseous products to prolonged cracking conditions, being conducive to the production of naphthalene and other products of decomposition. In working small horizontal charges for six-hour periods, the gaseous products of the distillation as they pass along under the soffit of the retort are exposed to radiant heat and contact with highly-heated surface. The velocity of these gaseous products through the retort is such that the time-contact with the highly-heated surface, and the effect of radiant heat, are sufficient to bring about very considerable decomposition, resulting in the formation of naphthalene among other products of such decomposition. The condensable vapours forming the tars, and permanent vapours contained in the gas, will consist partly of products due to incomplete decomposition formed in the early stages of carbonization, and partly of products resulting from secondary reactions taking place between the products of decomposition formed during the later period of the distillation, due to the gaseous products being exposed by contact to the highly-heated coked mass and retort surface, and for too long a period. These latter products will predominate; and the tar and gas will contain a large quantity of naphthalene, up to the point of saturation at low temperatures.

As to the second factor, the light hydrocarbon vapours produced in the process of distillation will consist partly of hydrocarbons the formation of which is due to incomplete decomposition, and of products due to secondary reactions brought about by exposure to radiant heat and contact with hot surfaces, as in the case of the tar. Paraffins may be cited as an example of the first order, and naphthalene as an example of the second. The relative proportions in which these hydrocarbons are produced will depend upon the conditions under which the coal is carbonized. Some of these hydrocarbon vapours condense, and become liquid at atmospheric temperatures, and others remain in a condition of vapour in the gas. The former come down in the condensers, where, if the gas is supersaturated with naphthalene vapour, a portion of naphthalene is also deposited, and carried away in solution by such condensates. Those vapours which do not condense go forward with the gas, together with such naphthalene vapour as has escaped absorption and deposition in the condensers.

Upon these gases and vapours entering the tar-washing apparatus, and coming into intimate contact with the tar, the bulk of them will be absorbed. The quantity of naphthalene absorbed by the tar will depend upon the capacity of the tar to absorb naphthalene. If the tar be already supersaturated, naphthalene will leave the tar for the gas; whereas if the solvents in the tar are not fully saturated, the naphthalene will be removed from the gas.

With regard to the third factor, the vapour tension of the naphthalene contained in the tar varies with the temperature of the tar, or, in other words, the capacity of the tar to absorb naphthalene and naphthas increases as the temperature falls, and decreases as the temperature rises.

The introduction of heavy charges working twelve-hour periods —the retort being completely filled—has been found to avoid all trouble with naphthalene. The "free space" above the charge is reduced almost to extinction; and, owing to the increased gas production per unit volume of retort space, the velocity of the gaseous products through the retort reduces to a minimum the time contact of such products to the heated surfaces. The early stage of carbonization under these conditions takes place at a comparatively low temperature, resulting in products of incomplete decomposition. Hydrocarbons of the paraffin series are produced, both gaseous and liquid, together with toluene, xylene, &c. Towards the end of the distillation—a high temperature being reached—benzene, naphthalene, and similar high-temperature products are formed; but, as a proportion of the total products of the distillation, they are in far less quantity than is the case with small charges of short duration.

Tar from small eight-hour charges yields upon distillation 4 per cent. by volume of light oils; the naphthalene content of the products of distillation being at a maximum as before-mentioned. The tar from heavy twelve-hour charges yields 22½ per cent. of such light oils; the naphthalene content of the distillation products being at a minimum. This well illustrates the reason of the absence of trouble experienced with twelve-hour work.

In cases where machinery for more or less completely filling the retorts does not exist, some advantage should be found by adopting as heavy a charge as can be put in. It is, of course, important that such a charge should be evenly laid.

Where small charges have to be worked in conjunction with the "C" process, there must necessarily be a shortage of solvents left in the gas after the washing process, and in many cases the naphthalene content of both gas and tars will be relatively high. The gas at the outlet of the washing apparatus, under some conditions of temperature in certain cases, will contain more naphthalene than at the inlet of such apparatus.

In these instances, some method should be adopted of adding to the gas what it lacks in the way of naphtha vapours of approximately the same vapour tension as naphthalene. The point at which the addition should be made must depend upon circumstances. If the naphthalene deposit takes place in the works plant, the vapour should be added at the outlet of the "C" process apparatus; but if peculiar to the distributing plant, at the inlet or outlet of the station meters.

Washing the gas with water-gas tar—provided such tar contains a large proportion of low boiling fractions—after the "C" process apparatus, would be a good method of further reducing the naphthalene content of the gas, and at the same time compensating for the previous extraction of naphtha vapours which should accompany the remaining naphthalene, and prevent its subsequent deposition in the solid form.

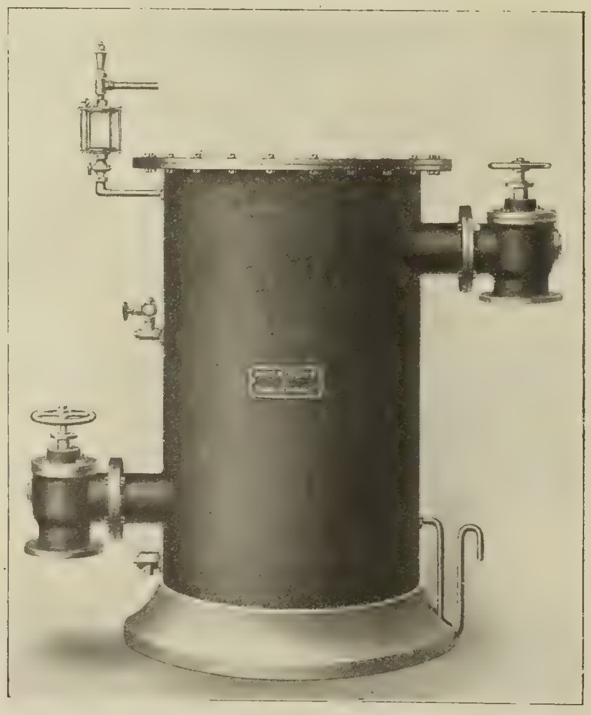
If circumstances prevent this system being adopted, the most direct way to prevent deposits is to vaporize into the gas ordinary petroleum at the rate of 20 gallons per million feet. Relief will follow almost immediately; and future trouble will be avoided by consistently following this practice, adjusting the quantity of oil vaporized to match the condition and quality of the gas from time to time.

It may be well to remember that the naphthas in water-gas tar contain a quantity of low-boiling paraffin bodies as well as those belonging to the aromatic series of hydrocarbons. These naphthas in the form of vapour are quite suitable for accompanying naphthalene vapour in the gas, and, if present in sufficient quantity, will prevent its deposition as a solid, but are unsuitable as a source of pure benzol and toluol.

PETROLEUM VAPORIZER FOR PREVENTING NAPHTHALENE DEPOSITS.

A Simple Apparatus and a Reliable Remedy.

The old trouble of naphthalene deposits in mains and services is again upon gas engineers in many places; and one has not to seek far for the cause. The trouble had been lightened considerably since heavier retort charging and longer duration carbonization became the practice, through which practice the quantity of condensable solvents for naphthalene in the gas was augmented, and the naphthalene content of the gas was correspondingly reduced. But the revival of the naphthalene difficulty in a form both disagreeable and irksome is due to meeting the requirements of the Ministry of Munitions regarding the extraction of benzol, toluol, &c. Although the almost generally used process by which this removal is effected reduces the number of grains of naphthalene per 100 cubic feet, it also largely depletes the gas of its naphtha vapours, and to such an extent that insufficient is left to accompany the naphthalene to the point at which, together, they condense out of the gas, and solid deposition results. The quickest and most obvious remedy for this is to restore to the gas an equivalent of that of which it is deficient for obviating the trouble. The addition to the gas of quite a small quantity of vaporized petroleum—ordinary burning oil, about ·780 to ·820 specific gravity, which readily vaporizers at the temperature of high-pressure steam, say from 300° to 320° Fahr.—will effectually prevent the deposition of solid naphthalene, and dissolve out any naphthalene crystals already deposited.



The Petroleum Vaporizer for Preventing Naphthalene Deposits.

Messrs. Parkinson and W. & B. Cowan, Limited, of Cottage Lane Works, City Road, E.C., opportunely call attention to a simple form of apparatus designed by Mr. Thomas Glover, M.Inst.C.E., of Norwich, for treating gas with petroleum vapour, either at the outlet of the purifiers or at the inlet of the holders. The carburettor comprises a cast-iron tank, inside which is fitted a suitable high-pressure steam-heated vaporizing arrangement. On to the heating surface of the vaporizer, the oil drops from a distributor; and the resulting vapour is carried off by the stream of gas passing through the apparatus. In regard to the structural details, the tank of No. 1 carburettor is 3 feet in diameter by 5 feet deep, inside measurements. The cover is fastened on with ½-inch bolts and nuts spaced 6 inches apart; the edges of the flanges being finished bright. The steam-coil inside the tank is made of a single length of 1½-inch internal diameter tube, about 90 feet long. It is connected to a 1-inch steam-supply pipe, controlled by a gun-metal valve; the outlet of the coil being carried to a ¾-inch steam-trap. With this steam-trap, while the quantity of steam used is but trifling, the high temperature of the vaporizing surface is ensured, as full boiler pressure can be used. The distributor is made of strong tinned iron, and is fitted above the steam-coil. The oil supply drops from a tundish, from which it flows to the distributor. The oil-supply pipe leading from the oil-tank to the apparatus passes through a sight-feed regulator and adjustment valve, fitted with a glass cylinder and shut-off cock. With the sight-feed, the approximate quantity of oil passing per hour can be seen by a minute's observation; and the valve permits of very fine adjustments being made to the flow of the oil according to the volume of gas passing. The inlet and outlet connections to the apparatus are 6 inches diameter, and each is fitted with a 6-inch screw-down disc valve with wheels, spindles, glands, &c. A syphon overflow is provided for condensed oil.

Among other considerations attaching to the use of these carburettors (a number of which have been successfully in service for several years) are these:

(1) It is easy to ensure a sufficient stream of gas passing through the carburettor to carry the vapour, by causing a slight back-pressure in the main, and so ensuring a difference of a few tenths between the inlet and outlet of the carburettor.

(2) When petroleum vapour is added to the gas in the way described, there is usually a slight permanent enrichment up to a maximum of 1 candle; and although this is not the main purpose of the apparatus, it is an incidental result which can only be considered a decided advantage.

(3) In addition to its primary purpose, the carburettor can be used for rapidly improving the value of the gas, when for some accidental reason this has temporarily become unduly low. When enrichment only is required, petrol or benzol is delivered into the carburettor, instead of petroleum.

(4) Petroleum and petroleum vapour are both extremely penetrating and destructive of ordinary joints. The carburettor has been designed with special reference to this difficulty; the joints being few in number, and these made in such a manner as to resist the solvent action of the oil.

Concerning the quantity of petroleum required, this will necessarily vary to some extent with local circumstances; but, under average conditions, it has been found that 25 gallons of petroleum will deal satisfactorily with about 1 million cubic feet of gas. Half this quantity may be used after the first month or so. In selecting a carburettor of suitable size, it is essential to bear in mind that it is sometimes necessary to vaporize the oil at a much greater rate in proportion to the quantity of gas sent out, as, if there is an accumulation of naphthalene deposits on the district, the addition of a considerable quantity of petroleum vapour is the cheapest and most efficient method of disposing of them. The sending out of the vapour in quantity would, of course, only be necessary when naphthalene deposits had accumulated, and then only for a short period.

A CRITICAL REVIEW OF THE METHOD EMPLOYED FOR DETERMINING HEATS OF COMBUSTION.

By Stanley Robson, M.Sc. (1851 Exhibition Scholar of the Armstrong College, Newcastle-on-Tyne), Research Student in the Department of Chemical Technology, the Imperial College of Science and Technology, London.

(*Continued from page* 534.)

Work of Marcellin Berthelot on the Determination of Heats of Combustion.

Berthelot's work in this connection must be dealt with in some detail, for not only is his experimental method essentially different rom that of Thomsen, but also his experimental results in some cases differ seriously from those of this contemporary worker. Berthelot's work may be conveniently divided into two periods. The first period embraces his work with combustion chambers similar to those of Favre and Silbermann. The second period embraces his work with the bomb calorimeter, and includes the redetermination of most of the values obtained during the former period. One matter to be regretted in connection with the pubished accounts of Berthelot's work is that detailed information concerning the preparation and purification of the substances examined is not always given. This is especially true in the case of gases.

Berthelot's Earlier Experiments.

Berthelot used an apparatus similar to that of Favre and Silbermann for his earlier investigations. The combustion chamber need only be described. This differed from others of its type in being constructed of glass. The oxygen was supplied through the tube *t* (Fig. VII.) and the products of combustion escaped through the glass spiral *s*. The solid or liquid to be burnt was placed in a porcelain crucible *r*, supported from the large rubber stopper B, which was protected from the flame during combustion by two mica plates *m m*. Piercing the stopper B was a tube T, through which a burning fragment of carbon was dropped in order to ignite the substance in the crucible *r*.

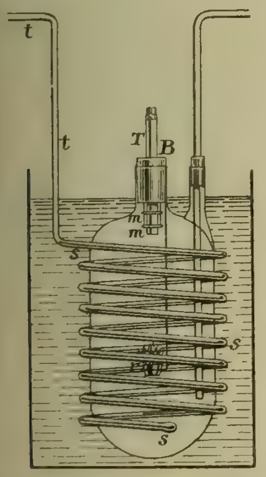


Fig. VII.—Berthelot's Combustion Chamber for Solids and Liquids.

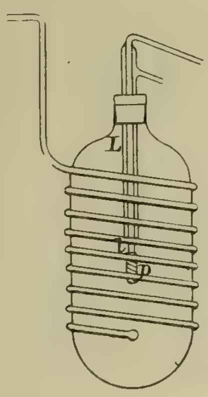


Fig. VIII.—Berthelot's Combustion Chamber for Liquids.

The modification of this apparatus for the combustion of gases is shown in Fig. VIII. The combustible gas was led into the chamber by the inner tube *l*, and was burnt on the surface of the platinum gauze *p* in a current of oxygen which was supplied through L. By means of the above method Berthelot obtained what he afterwards considered to be satisfactory results in the case of hydrogen, carbon monoxide, and sulphur.*

Berthelot's Investigations with the Bomb Calorimeter.

In a paper entitled "New Researches on the Measurement of the Heat of Formation of Organic Compounds," published in the "Annales de Chemie et de Physique," Fifth Series, Vol. XXIII., 1881, Berthelot expressed his dissatisfaction with the calorimetric methods used up to that time. His main objections were:

(1) The long duration of the combustion (10 to 15 minutes) which necessitated a large correction for the loss and gain of heat from the surrounding atmosphere.
(2) The incomplete character of the combustion.

He therefore proposed a method for the measurement of the heat of combustion of gases by detonation.

The apparatus employed in this research is shown in Fig. IX. The bomb was lined with platinum or gold, and the combustible gas, with the exact amount of oxygen required for its combustion or with an excess where permissible, was forced in or out as required, by means of a mercury pump and an apparatus analogous to Regnault's eudiometer, but of ½ litre capacity. The insulating material was of ivory, protected by mica. The capacity of the bomb was one litre. Owing, however, to the limited amount of material which could be placed in this volume with comparatively low pressures, the temperature elevation (read to $\frac{1}{100}$° C.) was only from 1·5° to 2° C., and the weight of carbon dioxide formed did not in general exceed 0·200 to 0·300 gram.

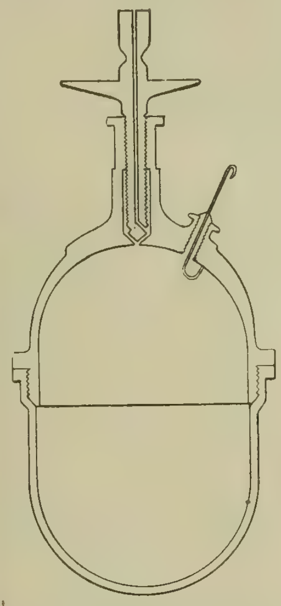


Fig. IX.—Berthelot's Original Bomb.

The quantity of gas burnt was measured, in the case of hydrogen, by its initial volume. The less difficult method of weighing the products of combustion was, however, generally adopted. Samples of the gas under examination were always, previous to an experiment, exploded in a eudiometer to see if it were pure, and likewise the final products were always examined for unburnt gases. Volatile liquids were weighed in glass globes and broken in the bomb. The values thus obtained were measures of the heat of combustion at constant volume; while combustion in open vessels gives values at constant pressure. To connect these quantities, Berthelot deduced the following equation:

$$QT_p = QT_v + 0·5424\,(n - n^1) + 0·002\,(n - n^1)\,T.$$

Where QT_p is the quantity of heat at constant pressure at the temperature T,
QT_v is the quantity of heat at constant volume at the temperature T,
n is the number of units of molecular volume occupied by the components,
n^1 is the number of units of molecular volume occupied by the products,
T is the temperature in centigrade degrees from the ordinary zero.

Berthelot's Method of Temperature Correction for Loss and Gain of Heat to His Bomb Calorimeter.

When dealing with heats of combustion by his bomb method, Berthelot's method of correction of the recorded temperature of the water of the calorimeter was similar to that of Favre and Silbermann. As he never allowed more than two to three degrees difference between the calorimeter and its surroundings, nor the temperature of the surrounding air to be more than 20° C., and more particularly since the maximum temperature was always reached in two to three minutes, this method was almost perfectly accurate. In such cases a consideration of the minute and half-minute readings made during the experiment gave sufficient data for the small correction which was necessary. To illustrate both his experimental method and his method of temperature correction, the following example of a determination of the heat of combustion of ethane (C_2H_6) is given.

Course of an Experiment.*

There was mixed 200 c.c. of ethane with 720 c.c. of oxygen over mercury and admitted to the previously exhausted bomb. The bomb was then allowed to stand in the calorimeter till the temperature rose or fell constantly. The experiment was then begun; the temperature being read every minute and the mixture fired at the sixth minute. The following temperatures were recorded:

Period Previous to Ignition.		Period of Combustion.		Period of Recooling.	
Time in Minutes.	Temperature.	Minutes.	Temperature.	Minutes.	Temperature.
0	13·295 C.	5	13·295	7	14·715
1	13·295 C.	6	14·740	8	14·735
2	13·295 C.	7	14·745	9	14·725
3	13·295 C.	..	..	10	14·715
4	13·295 C.	..	..	11	14·705
5	13·295 C.	..	..	12	14·695

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* "Traité Pratique de Calorimétrie Chimique," p. 216.

Carbon Monoxide.		Sulphur.
(1) 68·50	..	34·57
(2) 68·22	..	34·54
(3) 68·12	..	34·39
—	..	34·70

* This is the only experiment described in detail by Berthelot.

This being finished, the carbon dioxide was extracted from the bomb by means of the mercury pump, and carried slowly through a bulb of concentrated sulphuric acid—a U-tube of pumice moistened with sulphuric acid—and then through a Liebig tube of potash solution and a small U-tube of solid caustic potash. The bomb was then washed out three times with carbon dioxide free air, to extract the last traces of carbon dioxide formed during the combustion. The total weight of carbon dioxide thus formed was in this experiment 0·2090 gram.

The total heat produced was given by the product of the water and the water equivalent of the apparatus and the temperature variation.

$$\xi \mu \times \Delta t = (\mu_\omega + \mu_\epsilon) \times [(t_2 - t_1) + \rho]$$

where μ_ω = the weight of the water in the calorimeter,
μ_ϵ = the water equivalent of the apparatus,
t_1 = the temperature previous to ignition,
t_2 = the maximum recorded temperature,
ρ = the correction for loss and gain of heat from the surroundings.

Berthelot fixed his value for ρ in this case thus: "In the initial period of five minutes previous to the detonation, there was neither gain nor loss. The maximum was established a minute and a half after detonation. In the five minutes which followed (final period), the loss was regular, and equal to 0·01° per minute. From this the loss between the fifth and sixth minutes can be valued at a half—*i.e.*, 0·005°—and between the seventh and eight it is 0·01. The total correction ρ would therefore be 0·015°, which makes $\Delta t = 1{\cdot}465°$."

$$\therefore \xi \mu + \Delta t = (627{\cdot}4) \times [(14{\cdot}745 - 13{\cdot}295) + 0{\cdot}015]$$
$$= 627{\cdot}4 \times 1{\cdot}465$$
$$= 919{\cdot}14 \text{ calories.}$$

A certain amount of water vapour remained in the bomb, corresponding to the vapour tension of water at 14·74°. Using Regnault's figures, this correction amounted to 1·85 calories; making the true total heat equal to 919·14 + 1·85 calories = 920·99 calories. This was the heat of combustion of this quantity of dimethylene which produced 0·2090 gram of carbon dioxide. The heat of combustion of one gram molecule of ethane therefore was

387·78 Calories at C*v*
389·21 Calories at C*p*

In the above manner, Berthelot obtained the following results:

Carbon Monoxide.	Hydrogen.	Methane.	Ethane.	Ethylene.	Acetylene.
68·0 C*v* 68·3 C*p*	69·2 C*v*	213·2 214·3 210·7	384·6 388·7 389·7	341·0 341·4 337·0 341·9	318·7 311·0
		212·4 C*v*	387·4 C*v*	340·3 C*v*	314·9 C*v*
		213·5 C*p*	388·8 C*p*	341·4 C*p*	315·7 C*p*

It will be seen from the foregoing that Berthelot's original method for the combustion of gases by detonation was exactly similar in principle to that of Andrews. He appears to have been quite ignorant of Andrews' apparatus, though he was evidently in possession of his results—in fact, he was so far mistaken as to attribute to this worker the general methods used by Thomsen and Favre and Silbermann.[*] In view of the close association of Berthelot's name with the "Bomb Calorimeter," it is perhaps well to point out that Thomas Andrews originally conceived the method.

With the introduction of compressed cylinders of oxygen, Berthelot found it possible to make more accurate determinations of the heat of combustion of gases in the following manner. The volume of the bomb was accurately measured, and the combustible gas was forced into it at a small pressure. Sufficient gas was then allowed to escape to reduce the pressure in the bomb to that of the atmosphere. The amount of oxygen required was then forced into the bomb from the cylinder. The weight of the combustible gas was then known, both from its volume and from the weight of its products of combustion, which thus provided a check upon the experiments. The principal advantage, however, lay in the fact that a greater weight of material was used than in the previous experiments.

In this way the following values were obtained.[†]

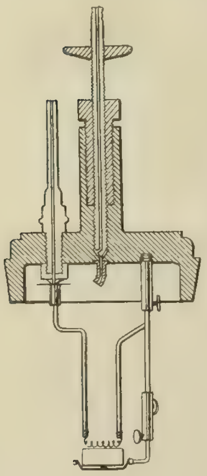

Fig. X.—Berthelot's Arrangement for the Combustion of Solids in his Bomb Calorimeter.

BERTHELOT.—*Heat of Combustion of Some Gases in Calories per Gram Mol. or Gram Atom.*

Substance.	Method of Preparation and Purification.	Values.
Hydrogen	No account given	68·9 66·8 67·9 68·2 67·95 C*v* 68·95 C*p*
Carbon monoxide	No account given; but it appears probable that it was obtained from oxalic acid. Berthelot affirms its purity in answer to a communication from Thomsen.	68·6 67·9 67·5 67·9 C*v* 68·2 C*p*
Ethane	Obtained by the electrolysis of sodium acetate, according to the method of Kolbe ["Ann. Chim. Phys." [5] XXIII., p. 179]. The gas was purified from ethylene by bromine, and from carbon monoxide by absorption over acid cuprous chloride.	371·5 370·6 370·5 370·9 C*v* 372·3 C*p*
Ethylene	Prepared from alcohol and sulphuric acid. The gas was quite absorbed (to 1 : 100) by bromine water or by concentrated sulphuric acid.	341·5 339·7 339·4 340·2 C*v* 341·3 C*p*
Acetylene	Prepared from copper acetylide.	318·7 311·0 314·9 C*v* 315·7 C*p*

A further advantage of the bomb calorimeter, however, was found to lie in its applicability to the determination of the heat of combustion of solids. No other form of combustion vessel will, in the case of the less-easily combustible solids such as carbon, allow the substance to be completely burnt. Thomsen did not carry out experiments with solids—thus avoiding the difficulty; while Favre and Silbermann and other workers corrected for incomplete combustion after a consideration of an analysis of the products, as previously described. The use of the bomb calorimeter, on the other hand, ensured complete combustion, and, moreover, avoided any external method of ignition.

Berthelot's modification of his original calorimeter for the determination of the heats of combustion of solids is shown in Fig. X.; but it is now so well known that it need not be described here.

Values of Berthelot and Petit for Carbon, in calories per gram.

Charcoal.	Graphite.	Diamond.
8136·6 8139·4 8140·6 8134·3 8141·8	7910 4 7896·5 7900·6 7900·6 7900·9	7853·6 7861·4 7862·2 7858·8
8137·4	7901·2	7859·9

The charcoal was purified by successive treatment with boiling hydrochloric acid, hydrofluoric acid, and chlorine. It was then calcined and cooled *in vacuo*, in order to remove hydrogen and moisture, and burnt in the bomb in oxygen under a pressure of 25 atmospheres.

The graphite (furnace) was purified by repeated extraction with hydrochloric acid. In order to aid the combustion, it was necessary to add naphthalene, whose heat of combustion, determined in four series of experiments by three groups of operators with three different pieces of apparatus, was regarded as known with great accuracy, and taken as 9692 calories per gram at constant volume. From one-third to a fifth of naphthalene by weight was added to the graphite and carefully melted in, so as to form a coating. To avoid occluded hydrogen, the graphite was always momentarily heated to redness. Even with the addition of naphthalene several milligrams of carbon sometimes escaped combustion, so that the platinum capsule which contained the carbon was weighed on the completion of the experiment. The diamond was broken to small pieces and extracted with hydrochloric acid.

STOHMANN'S WORK.

Using Berthelot's methods, Stohmann (a contemporary German worker) obtained highly accurate results for many of the more complex compounds. Of these only benzene and naphthalene are important in our connection.

Stohmann's Values for Benzene.

779·53 Calories per gram molecule = 9987·8 calories per gram.
This is the mean result of earlier experiments with Kleber and Langbein.[*]
779·0 Calories per gram molecule = 9981·04 calories per gram.
777·5 ,, ,, ,, = 9961·81 ,, ,,
Results of experiments with Rodatz and Herzberg.[†]

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[*] Ann. Chim. et Phys., Series 5, Vol. XXIII., p. 147.

[†] Ann. Chim. et Phys., Series 6, Vol. XXX., p. 350.

[*] J. Pr. Chem. [2], 30, pp. 241–260.

[†] *Ibid.*, 40, pp. 77–95.

Stohmann's Values for Naphthalene.

Calories per Gram Molecule.	calories per gram.
1232·1	9625·7
1232·5	9629·0
1230·4	9612·3
1234·9	9647·4
1232·2	9611·3
1230·2	9629 4
1233·8	9638·9
1233·0	9628·3
1232·4 at C*v*	9628·3 at C*v*
1233·6 at C*p*	9640·0 at C*p*

Stohmann's method of temperature correction is an application of the Regnault-Phaundler system. A series of observations taken every minute was made as soon as the temperature of the bomb is that of the calorimeter . . . "t_1" "t_2" "t_3" . . . "t_{n1}." When these differences were practically constant, the combustion was begun.

The temperature readings during the progress of the combustion were also taken every minute $\theta_1\ \theta_2\ \theta_3\ .\ .\ .\ \theta_n$. These were usually only five in number, and the first value θ_1 was equal to t_{n1}. A similar set of readings for the cooling were also taken:

$$t_1^1\ t_2^1\ t_3^1\ .\ .\ .\ t_n^1 \qquad t_1^1 = \theta_n$$

The average temperature rise (v) and fall (v^1) was given by the equations $v = \frac{t_{n1} - t_1}{n_1 - 1}$ $v^1 = \frac{t_{n1}^1 - t_1^1}{n_1^1 - 1}$. The average temperature before the ignition (T) is given by the equation:

$$T = \frac{t_1 + t_2 + t_3\ .\ .\ .\ .\ t_n}{n_1}$$

and during the observed cooling by:

$$T^1 = \frac{t_1^1 + t_2^1 + t_3^1\ .\ .\ .\ .\ t_{n1}^1}{n_1^1}.$$

The Regnault-Phaundler rule for determining the loss during the period of combustion is given by the equation:

$$\Sigma\,\Delta\,t = \frac{v - v^1}{t^1 - 2}\left[\Sigma_1^{n-1}\theta + \frac{\theta_n + \theta_1}{2} - n\,T - (n - 1)\,v\right].$$

The maximum temperature in this type of experiment is, however, almost reached after the first minute, so that $\theta_2 = \theta_3 = \theta_4 = \theta_n$ very nearly, and also $T = \theta_1$ and $T^1 = \theta_n$ approximately. There is not a uniform rise during the first minute, so that the true average temperature over this minute is somewhat higher than the arithmetic mean. Direct experiment showed that the correction to apply for this error is $\frac{\theta_2 - \theta_1}{9}$. The term $\Sigma_1^{n-1}\theta$ thus can be found by the equation:

$$\Sigma_1^{n-1}\theta = \theta_1 + \theta_2 + \theta_3\ .\ .\ .\ .\ + \theta_n + \frac{\theta_2 - \theta_1}{9}.$$

The following experimental details for the heat of combustion of anisic acid[*] will serve to illustrate the method of correction:

Weight of anisic acid burnt = 1·0770 grams.
Water equivalent of the apparatus = 2500 grams.
Temperature readings in m.m.

t_1 = 26 8	θ_1 = 28·9	t_1^1 = 214·0
t_2 = 27·2	θ_2 = 202·0	t_2^1 = 213·8
t_3 = 27·7	θ_3 = 213·0	t_3^1 = 213·6
28·1	θ_4 = 214 2	213·5
28·5	θ_n = 214·0	213·3
t_{n1} = 28·9		213·1
		212·9
		212·7
		212·6
		212·4
		t_{1n}^1 = 212·2

Therefore:

v = 0·42	T = 27·9	n = 5
v^1 = 0·18	T^1 = 213·1	

$$\Sigma\,\Delta\,t = \frac{v - v^1}{\theta_n - \theta_1}\left(\Sigma_1^{n-1}\theta + \frac{\theta_n + \theta_1}{2} - n\,T\right) - (n - 1)\,v$$

$$\Sigma_1^{n-1} = \theta_1 + \theta_2 + \theta_3 + \theta_4 + \frac{\theta_2 - \theta_1}{9} = 677$$

$$\therefore\ \Sigma\,\Delta\,t = \frac{0·42 - (-0·18)}{213·1 - 27·9}\left(677 + \frac{214 + 29}{2} - 5 \times 27·9\right) - 4 \times 0·2 = +0·45.$$

The corrected maximum temperature θ_n	= 2140 + 0·45 m.m. = 15° 3699 C.
The initial temperature θ_1	28·9 m.m. = 12°·8406 C.
The rise in temperature therefore	= 2·5293 C.
The amount of heat produced	= 2·5293 × 2500 cals. = 6323·3 cals.
Heat due to the wire ignition	= 17·3 ,,
Heat due to the formation of nitric acid	= 8·2 ,,
Therefore 1·070 grams anisic acid yield	6306·0 ,,
One gram anisic acid yields	5893·5 ,,
One gram molecule ,,	895 8 Cals.

(*To be concluded.*)

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[*] This experiment is described in greater detail than those on benzene and naphthalene.

CARE AND MAINTENANCE OF "DE BROUWER" RETORT CHARGING AND DISCHARGING PLANT.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

[*Concluded from p.* 537.]

Electrical Arrangements.

These arrangements are substantially the same as in the case of the projector and ram machines; the current passing from the collectors into a double pole switch and thence, *viâ* a single pole circuit breaker, to two distributing plates. From these plates two circuits are taken; one pair of wires going into the travelling-hoisting controller and one pair to connect to two of the three vertical banjo wires strained up the side of the outer frame. The control gear for the ram and the projector motors take their supply from these two wires by means of spring collecting contacts fixed on the inner frame; while the shunt current from the projector motor returns to the negative plate *viâ* the third banjo wire, between which and the negative plate the adjustable rheostat is connected in circuit for the purpose of regulating the speed of the projector motor.

The arrangements for raising and lowering the inner frame are exactly the same as in the separate machines; the work being performed by the travelling motor through a clutch. In the case of the complete stoker, however, this motor is rated according to the extra load with which it has to deal, and is, as already mentioned, the exact duplicate of the ram motor—a practice which greatly reduces the number of motor and controller "spares" which it is necessary to keep. The regulator for controlling the speed of the projector motor is fixed on the outer frame; while the starting switch is fixed on the hanging frame at the back of the motor.

As in the case of the separate machines, an automatic tappet switch is connected in the main feeder cable, in order to ensure that, upon the travel of the inner frame exceeding the limits of safety, the current is automatically cut off. In connection with this switch it may be remarked that the safety appliance can be so arranged that, upon the arrival of the inner frame at either of these positions, the controller of the travelling hoisting motor can be automatically brought to the "off" position; but a tappet-operated switch performs the same desired result with a less degree of mechanical complication.

Maintenance.

The chief factor in the successful operation of electrically driven retort stoking machinery is cleanliness and efficient lubrication; and no effort should be spared to keep the entire machine in a reasonably clean state, and to see that all oil holes and grease cups are plentifully supplied with lubricant, particular attention being given to the projector drum, motor, and pulley bearings.

Another important portion of the machine to which special attention should be given in this respect is the shaft which passes through the centre of the hoisting worm and travelling pinion, and carries the clutch. In order that the portion of the shaft passing through the worm may be lubricated, two holes are drilled through the latter, one in the centre of each bearing and one in the clutch end of the worm, and a deep groove is cut in line with the worm in such a manner that, when the groove is on top, the oil holes are vertically under the Stauffer lubricator in the cap of the two bearings, and by screwing-down the caps grease can be forced direct on to the shaft.

The clutch, which is controlled by one handle, serves to put either the hoisting or the travelling gear into operation, or, if desired, it can be put into a neutral position and the motor run idle. Care should be taken to engage the respective motions without any undue shock; this being best accomplished by placing the clutch in the neutral position and throwing the controller handle to the first notch and back again to the off position as soon as the motor starts to turn around. Just as the motor is on the point of stopping, the clutch lever should be thrown sharply over to the desired position, when it will be found that the clutch will fall quietly into gear without any undue shock. The practice of holding the clutch hard-over in the required position and then engaging it by starting the motor is a pernicious one, and can only result in damage to the machine.

Too much emphasis cannot be laid on the importance of frequent inspection of the machine and all gearing. By this means, and by intelligent observation of the behaviour of the machine when under load, it is possible to detect and rectify incipient faults which, if allowed to go unnoticed, will result in a stoppage. The motors in the machines work in extremely dusty places, and there is always a tendency for oil and coal dust to gather inside the carcase of the machines. Such accumulations form a most destructive mixture, which tends to perish the insulation on the field and the armature windings and afterwards to support the short-circuit brought about in this manner between the windings and the frame of the machine. The motor casings and controllers should be blown out every day by means of a pair of common bellows, and afterwards wiped out by a cloth (not cotton waste) moistened, if necessary, with methylated spirits.

The projector-motor is particularly liable to suffer from lack of attention in this respect, owing to the cramped dimensions of the box it is housed in. The brushes and their holders should be examined daily, there always being the possibility of their working loose and causing damage to the armature by coming into collision with its windings. The oil in the motor bearings (particularly the bearings of the projector motor) should be frequently changed; it being by no means unusual for fine dust to work into these bearings. The motor controller and resistance connections should be gone over daily, in order to make sure that they are perfectly tight, and the projector regulating resistance should be carefully examined for loose connections, as an open circuit occurring on the field of an excited shunt-wound motor may easily bring about the destruction of the machine, to say nothing of causing injury to an operator.

Should the speed of the projector motor become excessive and the motor spark badly at the brushes, it is due to an open circuit, or partially open circuit, in the field, and the connections of the same should be examined throughout—coils, rheostat, and banjo wire collector. The same care should be taken if the motor is noticed to attain any unusual speed on any particular point of the regulating resistance. Such an occurrence is due to a weak field, and is invariably accompanied by an abnormal armature current; and the fault should be located and remedied before this current results in a "burn out" of the armature.

It sometimes happens that when the projector motor is being speeded-up for charging a retort, the hold-up magnet upon the starter releases the radial arm and allows the starter to fly back to the off position. This is usually due to poor magnetic contact between the poles of the hold-up coil and the small pole piece attached to the starter arm. Sometimes these fitments may have worked loose and require readjusting; while at other times the trouble is only caused by the presence of a little rust or dirt.

The overload release of the starting switch must be loaded up sufficiently so as not to cause a release of the arm due to the momentary rise of current when speeding-up the projector. The setting which is usually found to give satisfaction on a 230-volt circuit is about 25 to 30 amperes. It sometimes happens that the release spring gets bent and remains in contact, thus permanently short-circuiting the hold-up magnet. This is the first point that should be noted should the no-volt coil fail to hold up. The banjo wires strained up the side of the machine for the purpose of conducting current into the hanging frame should, with their collectors, be cleaned daily, and all accumulations of coal dust and dirt carefully removed from the insulators at the top and bottom of these wires.

General Remarks.

It not infrequently happens that when a new type of machine is put to work it is so unconsciously abused and mishandled during the first year of its use, owing to its characteristics not being fully understood, as to seriously detract from the period of its useful life. It must be borne in mind that many troubles that occur to heavy machinery of this class are due not so much to the machine itself as to the conditions under which it is put to work; and while these conditions can in most cases be rendered ideal if properly considered before the machine is erected, it is often impossible to alter, or even modify, them when once the machine has been delivered and put to work.

A matter to which too much primary attention cannot well be given is the design of the track on which it is meant to work the new machine. Under this heading it must be remembered that the track is subjected to a strain which, so far as the author is aware, is peculiar to this class of undertaking—namely, the back-thrust brought about by the action of the ram on the caked coke in the retorts. A very common error is to utilize an existing set of rails on the charging side of the benches without giving proper consideration to the question whether they are of ample section, and sufficiently well supported and anchored, to operate satisfactorily under a machine weighing perhaps twice as much as the one, or ones, for which they were originally laid.

A well-designed track of ample rail section should be provided. In this connection, it will be found that the makers of the machine for their own sakes, are invariably willing and anxious to give advice on this all-important subject. A poorly-designed track is a source of continual trouble, and, from the writer's own experience, is responsible for those most annoying of all breakdowns—mechanical breakdowns to which no reason can be assigned, and which leave everyone concerned in a state of uncertainty as to when it is going to happen again, and with the uncomfortable feeling that, though the consequence has been remedied, the cause still exists, and may at any moment bring about a recurrence of the trouble and still remain undiscovered and shadowy—the subject of endless conjecture and theorizing.

Use of the Recording Ammeter.

One of the advantages incidental to electrical driving is the ease with which the energy consumed by any particular machine can be checked and, if necessary, recorded automatically by a recording ammeter fixed in the circuit. A meter of this description fixed in the stoking machine circuit will be found to give records of the greatest value if properly dated and filed away. The current taken by the machine on every operation will be registered by means of a line on the chart, and any unusual performance of the machine will be recorded against the exact time at which it took place. It will thus be seen that the recording ammeter will furnish a continuous record of the condition of the machine, the handling of the controller, and the state of the retorts and the character of their contents (shown by the current required for discharging them taken by the ram motor).

Smooth and efficient working can be greatly facilitated by co-operation between the carbonizing foreman and the electrician in charge of the plant, as the latter, if advised from time to time as to the state of the contents of the retorts, can alter his circuit breaker according to the varying nature of the coke. With certain coals it will be found that the maximum current taken on the discharging stroke is greater than with others; and while such cargoes are being worked through, much delay may be avoided by setting the circuit-breaker a little higher.

Other factors which are closely connected with the satisfactory operation of machines of this general class are: (1) The arrangement of feeder wires, (2) the training of operators, and (3) the selection of switchgear. While a careful consideration of these points is essential to the production of a useful article, the author does not desire to repeat much of that which he has already written in former articles, and will content himself with referring interested readers to those articles. While not dealing directly with "D.B." retort machines, the points raised are really applicable to any type of electrically driven charging or discharging machinery, and will be found to have been comprehensively handled in the following issues of the "Journal:" April 14 and 21, 1914, Jan. 12, 19, and 26, 1915.

In conclusion, the author desires to express his thanks to Messrs. W. J. Jenkins and Co., Limited, of Retford, the makers of the "De Brouwer" machines forming the subject of this article.

INSTITUTION OF WATER ENGINEERS.

The Twentieth Winter General Meeting of the Institution was held last Friday, at the Apartments of the Geological Society, Burlington House, W. The President (Mr. F. W. M'Cullough, M.Inst.C.E., of Belfast) was in the chair; but the attendance, owing to the war, was not large.

The Majority of the Organization.

The President, in opening the proceedings, commented on the fact that this was the final meeting of the twentieth year of the existence of the organization; and so next year the Institution (which was established as the British Association of Water-Works Engineers) would attain its majority.

Minutes and Accounts.

The Secretary (Mr. Percy Griffith) read the minutes of the last summer meeting; and they were confirmed.

The President submitted the annual accounts; mentioning that there was a balance of £88 18s. 2d. on the right side as the result of the year's working.

The accounts were adopted.

Office-Bearers.

Mr. G. T. Edwards and Mr. W. R. Jenkins were appointed Scrutineers of the balloting list, and later reported the following elections:

President: Mr. F. W. M'Cullough, Belfast.

Vice-Presidents: Mr. A. B. E. Blackburn, of Sunderland; and Mr. S. C. Chapman, of Torquay.

Ordinary Members of Council: Mr. J. C. Barrowclough, of Batley; Mr. F. J. Dixon, of Ashton-under-Lyne; Mr. H. C. Head, of Winchester; Mr. C. B. Newton, of Hull; Mr. H. Preston, of Grantham; Mr. C. H. Priestley, of Cardiff; Mr. C. H. Roberts, of Aberdeen; Mr. E. J. Silcock, of Leeds and Westminster; Major H. W. Woodall,* of Bournemouth; and Mr. William Matthews, of Westminster.

[* On Active Military Service.]

The constitution of the Council is the same as before, with one exception—Mr. Matthews taking the place of Mr. A. J. Jenkins, of Jersey.

Moved by the President, and seconded by Mr. A. B. E. Blackburn, Messrs. Wood, Drew, and Co. were appointed Auditors, with Messrs. Arthur Valon and W. J. E. Binnie, B.A., as Honorary Auditors.

The Definition of "Domestic Purposes."

A paper, entitled "Notes on the Definition of the Term 'Domestic Purposes' in General and Private Water Acts," was then submitted by Mr. A. B. E. Blackburn and Mr. Percy Griffith. A long discussion followed; and a report of this, with the paper, will be published in an early issue.

Next Meeting.

The President, in reiterating the desire (expressed at the previous meeting) of his Committee and himself that the members should visit Belfast for their next summer meeting, said that the Council of the Institution had accepted the invitation provisionally, and would consider the details at their meeting next March.

A hearty vote of thanks was passed to the President and Council of the Geological Society for the use of their apartments.

THE PRODUCTION OF PHENOL IN GERMANY.

In an article in the "Zeitschrift für Angewandte Chemie," Dr. Raschig, of the Baden Aniline and Soda Works at Ludwigshafen, states that the details of a process devised by him for the extraction of carbolic acid from German coal-tar products have hitherto been kept secret; but in present circumstances this policy will no longer be adhered to. Hostile nations cannot profit by the disclosure, as the only countries besides Germany in which tar distillation has been developed are Belgium and Great Britain. The Belgian distilleries are now in German hands, and as English tars are much richer in carbolic acid than German, it has always been the practice of English tar distilleries to extract it.

Prior to the war, German requirements were chiefly met by the importation from England of crude carbolic acid, which was worked-up to various refined products. This was due partly to the greater richness of English tars in carbolic acid, and partly to the greater development of the English gas industry, which is shown by the fact that at the close of the last century the German production of coal tar was probably not one-third of that of Great Britain. The expansion of coke production in recovery ovens in Germany has, however, now raised the German output of coal tar at least to an equality with the English; but the German oven tars are comparatively poor in carbolic acid. Extraction of the latter from them had, however, progressed to such an extent that at the outbreak of war carbolic acid was obtained from about one-third of the German production of tar. The carbolic acid was left in the tar oils from the remainder of the tar, and was therefore wasted when these oils were used as fuel or solvents, or for preserving timber.

The cutting off of the English supply of carbolic acid to Germany which ensued on the outbreak of war led, Dr. Raschig explains, to a scarcity in the latter country, which was enhanced by the large demand for it for the manufacture of picric acid. As Britain as well as Germany has prohibited the export of carbolic acid to neutral countries, there is even greater scarcity of it in the latter; and this will be still more keenly felt after the conclusion of peace, when these countries again seek the supplies from Germany which they were wont to take. Hence Dr. Raschig regards it as a German national duty to work-up all the available supplies of carbolic acid. Plant is to be provided to distil off the carbolic oil fraction—which comes over generally between 170° and 200° C.—from the coal tar. This fraction contains between 25 and 35 per cent. of constituents soluble in alkali. Works are being erected to supplement those already existing for the extraction of the phenols from the tar oil by washing with soda lye. This can only prove remunerative in large works, because the soda extract has to be decomposed by carbonic acid into crude carbolic acid and sodium carbonate, and the latter has to be re-causticized (for use again) by means of quicklime. The works therefore must have lime-burning and soda-causticizing plant, both of which are unprofitable unless worked continuously, which would be out of the question for a moderate sized tar-works handling (say) 200 tons of tar daily, and producing therefrom about 10 tons of carbolic acid.

Except therefore in the case of large tar distilleries handling 100,000 tons of tar per annum, the distilleries will have to collect the carbolic oils and send them to special works for extraction by means of soda lye. Dr. Raschig's process also utilizes the phenols contained in the light tar oils, now generally wasted; and a considerable proportion of phenol is also recoverable from the crude benzol of coke-oven works. Altogether it is estimated that from German gas tar, oven tar, and benzol 6000 tons of crystallized carbolic acid may be extracted per annum, whereas the present output is scarcely 2000 tons.

Another possible source of phenol is its synthesis from benzol by sulphonating and treating the sulphonate with soda. But this method of production would use up large quantities of benzol and sulphuric acid, both of which are at present greatly needed for other purposes. [This method of production is, however, described in detail by Mr. A. H. Ney in a communication of which an abstract, taken from the "Journal of the Society of Chemical Industry" of Nov. 15, is given below.—Ed. J.G.L.]

Abstract of Paper presented by Mr. A. H. Ney to the National Exhibition of Chemical Industry held in New York last September.

The communication dealt with the subject of "Synthetic Phenol and Picric Acid;" and the summary points out that up to the time of the Boer War synthetic phenol had only been produced in small quantities; but at that time, owing to the embargo placed on phenol, there was a considerable shortage on the Continent, and Herr F. Raschig commenced the manufacture on a large scale at Ludwigshafen, and has continued it since whenever the comparative prices of benzol and phenol made it remunerative. In America it had not been produced up to the outbreak of the present war, when Edison, who wanted considerable quantities for the production of the artificial resins used in making his phonographic disc records, took up the manufacture.

Manufacture of Synthetic Phenol from Benzol.—The benzol is sulphonated in a cast-iron vessel of 300 to 350 gallons capacity, provided with heating and cooling means, and connected to a reflux condenser. An agitating device is used, consisting of two oppositely mounted propellers on a vertical shaft or of one complete turn of a broad spiral, which is rotated in an open cylinder. Into the vessel 410 lbs. of 98 per cent. sulphuric acid and then 153 lbs. of benzol are run, and the agitator is started. The temperature rises to 62° to 68° C.; and when no further rise takes place, the vessel is heated to about the boiling point of benzol. The sulphonation takes about seven hours. The resulting sulphonic acid is run into a lead-lined vessel, and neutralized first with milk of lime and finally with waste calcium carbonate. The mixture is boiled for about thirty minutes (a little water being added if it becomes too thick); and then, after turning off the steam, water equal to one and a half times the volume of the original sulphonation mixture is run in. These precautions are necessary to ensure the calcium sulphate being in a suitable condition for filtration and washing. The mixture is pumped through a filter-press, and is washed with about 50 per cent. of its volume of water. The calcium benzenesulphonate solution is treated with solid sodium carbonate to convert it into the sodium salt. The precipitated calcium carbonate is used to neutralize the sulphonation mixture; the sodium benzenesulphonate solution is evaporated; and the product is dried and powdered. In a fusion vessel of about 300 gallons capacity 480 lbs. of caustic soda and 30 to 50 lbs. of water are melted, heated to 270° C., and 600 lbs. of dry sodium benzenesulphonate added. The temperature rises to about 300° and is finally raised to 315° C., when the heating is stopped. A slight further rise of temperature takes place, and the operation is complete when all the sodium salt has dissolved, and the melt becomes thin. The product is ladled out into shallow trays, cooled, roughly crushed, dissolved in water, and treated with dilute sulphuric acid until the evolution of sulphurous acid begins. A lead-lined vessel is not necessary, as only sufficient acid to form the bisulphite is used. The sulphurous acid is blown out with air, and the crude phenol separated and distilled. The crystalline phenol obtained frequently possesses a disagreeable odour, due to sulphur compounds, which can be removed by digesting or distilling the crude phenol with animal charcoal. Many so-called improvements have been proposed, but have not been successful in practice.

Manufacture of Picric Acid.—Technically, two methods are employed: (I) Phenol is first sulphonated and then nitrated with a mixture of nitric and sulphuric acids; (II) chlorobenzene is nitrated, the dinitrochlorobenzene formed is heated with caustic soda, and the resulting dinitrophenol is nitrated. The first process is most generally used, and is carried out as follows: One part of phenol is sulphonated with four parts of 98 per cent. sulphuric acid in a large steam-jacketed vessel provided with an agitator. The resulting sulphonic acid is treated in a nitrating vessel, provided with cooling and heating coils, with an equal amount of sulphuric acid cooled to 20° C.; and the nitrating acid, usually a mixture of equal parts of nitric and sulphuric acids, is run in. Instead of the three molecules of nitric acid required by theory, four are used. The contents of the vessel are kept below 40° C., while the first 30 or 40 per cent. of the nitric acid is added, and raised gradually to 70° or 80° C. The contents are then transferred to a non-metallic acid-proof vessel, and diluted with an equal volume of water. The crystals which separate on cooling are drained on a vacuum filter. A purer product is obtained by melting the crystals and running the melted material through a sieve of gold or platinum into cold water in a wooden tank. Large makers of picric acid use a filtering box, in which a vacuum can be applied both above and below. The crystals are first drained by the vacuum, and then washed with alcohol spray, which removes the resin formed in the nitrating process. A cover is then put on, and vacuum applied above so as rapidly to dry the crystals.

The Institute of Arbitrators.

Members of those professions whose services are usually invoked for the purpose of acting as arbitrators have combined to form, both for their own benefit and in the interests of the general public, an Institute of Arbitrators; and this new Institute—the President of which is the Right Honourable Lord Headley—has now started a "Journal," to be published quarterly, at No. 32, Old Jewry, E.C. The first issue of this new publication opens appropriately with an explanation of the aims and objects of the Institute, one of which, it is noted, is "to provide means for testing the qualifications of candidates for admission to the professional membership of the Institute by examination in theory and practice," and another "to promote and encourage the practice of the settlement of disputes by arbitration." The minimum age for admission to membership of the Institute has been fixed at 21 in the case of associates, and 30 for the degree of Fellow. There is an influential Council, the members of which have been selected with a view to rendering it thoroughly representative of the various professions to which the Institute is intended to appeal. The "Journal" contains a number of articles of special application to the subject of arbitration, as well as a report of the proceedings, which were formal in character, at the first annual meeting of the Institute.

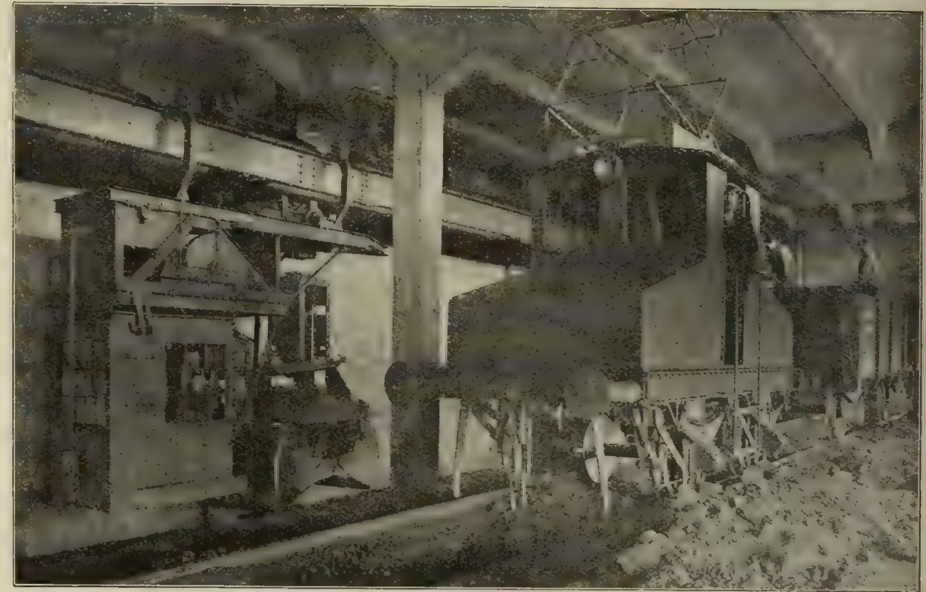
The "Bulletin of Agricultural and Commercial Statistics," dealing with the international movement of chemical manures during the first half of this year, says that, regarding sulphate of ammonia, Great Britain exported during the first six months of 1915 a total of 162,543 metric tons, as against 318,914 tons for the whole of 1914, and 328,238 tons for 1913.

EXTENSIONS AT THE MAESTRICHT GAS-WORKS.

Carbonizing in Chamber Ovens.

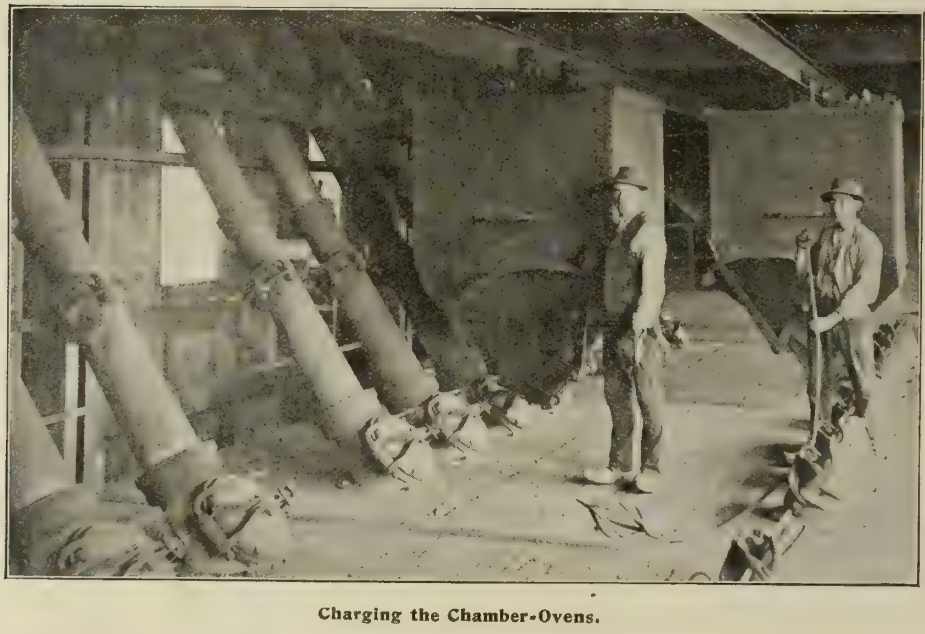
New carbonizing and auxiliary plant at the Maestricht Gas-Works has been erected on a site of about 10 acres, divided into two parts, one of which is 20 feet higher than the other.

On the lower portion of the site, a railway siding connects the new plant with the old gas-works. This siding runs up to the higher ground, where there is a connection with the coal-stores. The railway is electrically operated, by motors capable of drawing a train of 60 tons weight, at a speed of 2½ miles per hour. The direct current for operating the motors is delivered overhead, and is furnished from a transformer which also supplies current to the telpher system.



Electric Locomotive and Coal-Grab at the Maestricht Gas-Works.

The coal-storage is of a total capacity of 2900 tons, and is divided into seven bunkers. Above these bunkers, and directly under the flat roof of the store, there is a railway-viaduct, the upper side of the rails on which are 20 feet above the lower works level. The bottoms of the bunkers are inclined, in the case of six of them, under 35°, and the seventh under 45°. The coals are pushed by hand from the waggons into bunkers. The bunker having the greatest bottom inclination is situated above a conveyor, which takes the coal from the shoot of the bunker to the breaker. The coal breaker and conveyor are operated by a rotary current motor of 7½ H.P. The coal-breaker has a capacity of some 20 tons per hour.



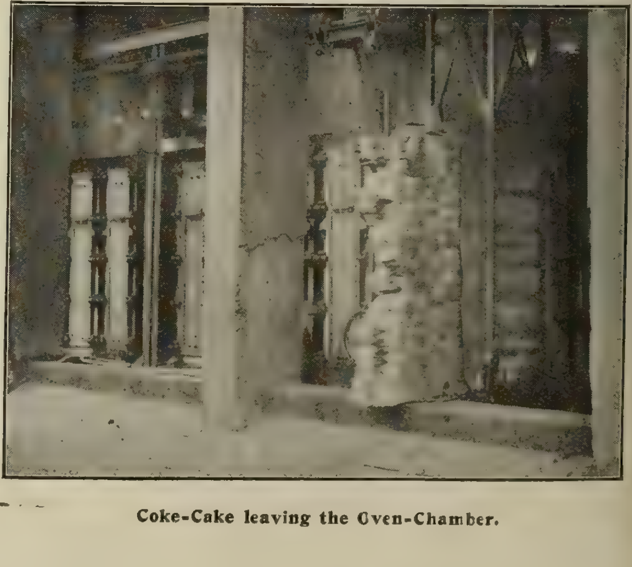
Charging the Chamber-Ovens.

The broken coal falls into the shoot of an elevator which transports it to a high-level bunker, of a capacity of 100 metric tons of coal, and constructed in a special concrete building, between the coal-store and the carbonizing house. This building is also arranged to accommodate the boiler plant and water-tanks. Thus it is possible to take the coal from the railway-waggons, break it, and place it in the high-level bunkers, without manual labour.

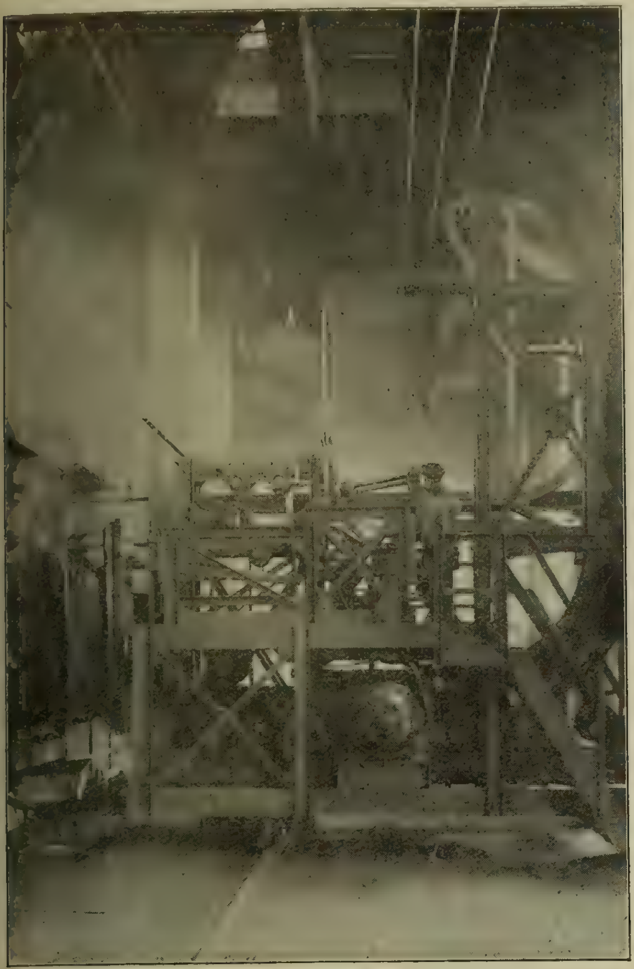
For the transport of the coal from the six storage bunkers to the seventh bunker, there runs through the store an electrical overhead monorail, the upper side of which is 35 feet above the lower ground level. To the telpher car there is attached a grab, raising a metric ton of coal at a time. This grab is also used for transporting coal to a smaller bunker placed in line with the coal-store. But as this small bunker has no special breaking plant, a screen has been provided on which the grab is emptied. The large lumps of coal that happen to remain on the screen are then broken by hand.

The retort-house is of concrete, and has a superficial area of 120 feet by 215 feet. It contains five horizontal large chamber-ovens, in two groups of three and two ovens. Each oven has four chambers, 17 ft. 6 in. long, and is equal to taking a charge of about 3½ tons of coal. The carbonizing period extends over 24 hours, during which time, with first-class coals, the production per oven amounts to 157,500 cubic feet of gas. The chambers are charged by means of two hoppers, suspended from an overhead rail. The coal is discharged from the high-level bunker into these hoppers, which are moved easily by one man to the charging openings of the chambers. The ovens have a common chimney-stack 130 feet high, and 5 feet internal diameter.

The removal of the chamber-doors, the pushing out of the coke, and the levelling of the coal, is performed by an apparatus made by the Dillinger Engine-Works, Franz Méguin, at Dillingen (Saar). This apparatus is driven by a rotary current motor of 21 H.P., and is worked by one man. On the coke side of the ovens, the doors are moved by a hand-operated car, serving at the same time as a coke-pushing car, for taking the coke to the quenching-shoot. The charging of the ovens is carried out every 24 hours by five men—one to work the pusher and leveller, one for opening and shutting the doors on the engine-side, two for the same work on the coke-side, and one for charging the chambers and cleaning the ascension-pipes. The charging generally occupies not more than ten minutes. The quenching-shoot is of concrete, covered with cast-iron plates; and on gratings upon the lower side the coke is quenched by jets of water. Under the lower side of the quenching shoot a car runs, operated by a chain The car is provided with a vertical shoot, enlarged at the upper end. Down this shoot is lowered an iron bucket, suspended from an electrical telpher. The telpher runs along the quenching shoot and the coke-storage ground. By means of a lever, arranged on the car with the shoot, the doors of the coke-quenching shoot are opened; and the coke falls down the car-shoot, into the iron bucket suspended therein. When the bucket is full, it is raised, and transported by the telpher to the desired spot on the coke-heap, where the bucket is emptied. As the railway crosses the telpher line, it is possible to discharge



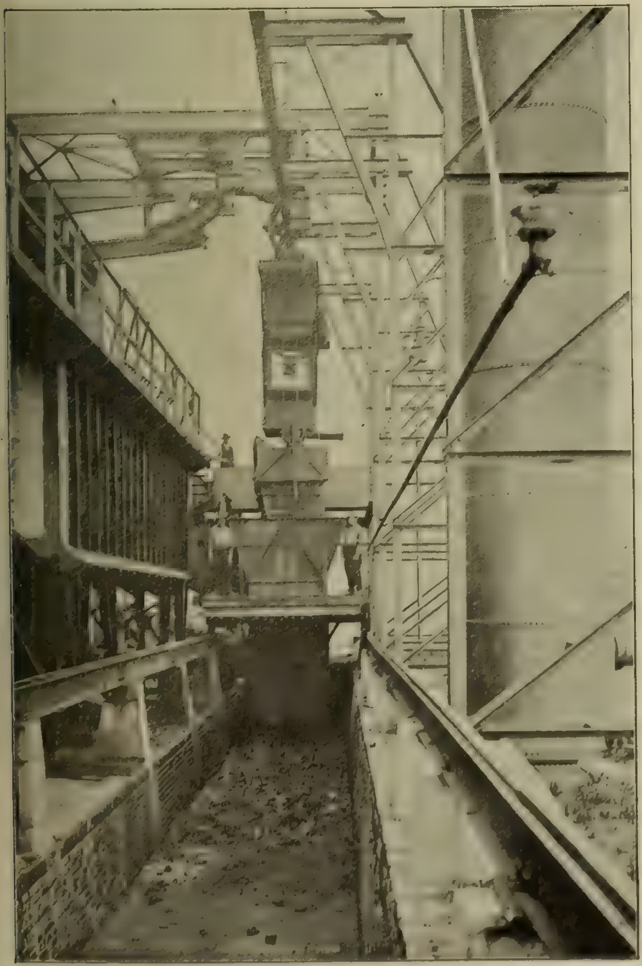
Coke-Cake leaving the Oven-Chamber.



The Coke-Ram at the Maestricht Gas-Works.

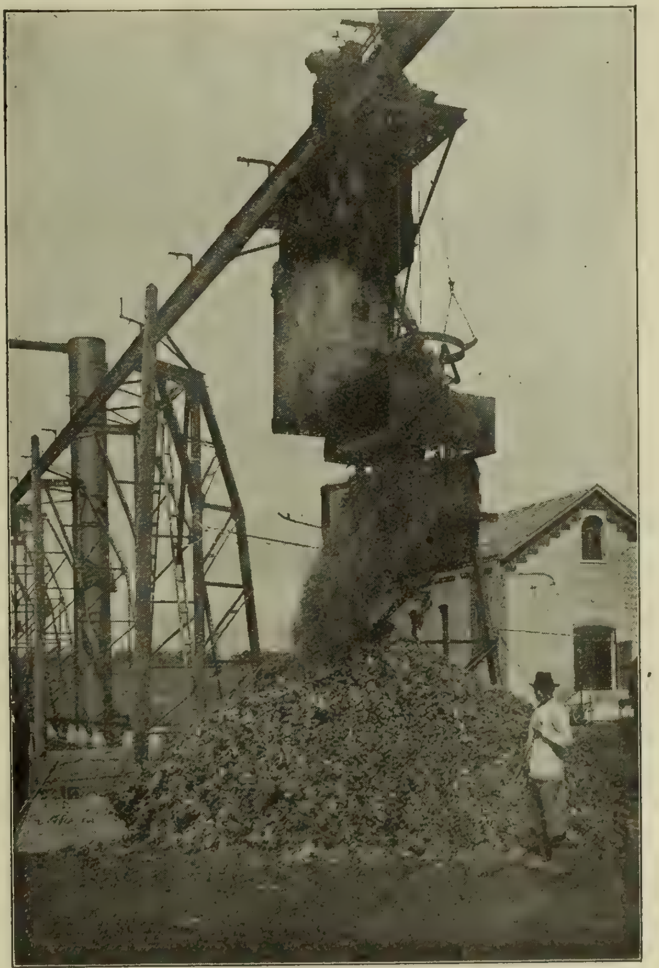
the coke-bucket immediately into railway-waggons without entailing any extra cost.

The coke-telpher is connected by a switch to the telpher in the coal-store, which allows of the discharging of coal from railway-waggons with the grab bucket, or of filling the waggons with coke from the heap by means of this grab. Both telphers are of the same pattern, so each car can take the place of the other. The telphers are operated by the workman who manipulates the coke-ram and levelling apparatus. During the charging of the coke-bucket, assistance is given by two of the stokers. The quenching and the transporting of the coke occupies some 15 minutes for each chamber.



Coke-Handling Plant at Maestricht.

The charging of the producers is done by hand, with a bogey, charged from a coke-bunker, and emptied through the bottom. The hydraulic mains are on the upper side of the ovens, and easily accessible by means of a concrete stage floor. The pipe condenser is inclined on a special stage in the upper part of the retort-house, and is also accessible by means of a concrete staircase. The gas passes through an annular air-condenser and an underground main to the exhauster-house, situated 100 feet distance from, and parallel to, the retort-house. Here there are arranged the exhausters, the tar-extractors, naphthalene-washer, and ammonia-washer, from the old works, all of 900,000 cubic feet per day capacity. The gas, freed from tar, naphthalene, and ammonia, is taken through a 16-inch main 2000 feet long to the purifier-house of the old works. From the old works, a 5-inch pipe supplies purified gas to the new works for the lighting of the plant and for heating and power purposes. The power for the exhausters and the washers is obtained from two 26 H.P. gas-engines.



Discharging Coke from the Coke-Bucket.

The lighting of the retort-house, the coal-store, and the yards is by means of high-pressure and low-pressure gas. The tar and ammoniacal liquor are collected in concrete tanks. Electric current is taken from the municipal system, and transformed to meet the requirements of the works.

Use of Gas Lime in Agriculture.—In the course of a letter to the "Newcastle Daily Chronicle," on the use of lime as a check to "finger-and-toe" disease in swedes and turnips, Mr. Douglas A. Gilchrist, of Armstrong College, quotes five dressings which have been found to be effectual, applied for the previous oat crop, before ploughing the ley. One of these dressings consists of 4 tons per acre of gas lime, the cost of which is put at about 12s. The writer says gas lime so applied is a great help, though not so effective as lime mud, in checking the disease; but it "is usually the most effective in helping the succeeding oat crop, probably because of the small amount of nitrogen it contains. Gas lime should be very carefully spread on the hay stubble, and all lumps broken and spread. Ploughing should not be done until at least six weeks after the gas lime is applied. Exposure to the air for this time renders harmless the small amount of poisonous matter. As gas lime can now, and for the next few weeks, be obtained at a very low cost, farmers who fear finger-and-toe disease on turnips are strongly advised to take advantage of this low cost, and to apply gas lime as directed. Its use may also be helpful to a certain extent in checking attacks of leather jacket grub or wireworn on the oat crop."

GAS V. COAL FOR DOMESTIC PURPOSES, AND THE CAMPAIGN AGAINST THE KITCHEN RANGE.

By W. L. Westbrook, of the North Middlesex Gas Company.

[A Paper read before the London and Southern District Junior Gas Association, Dec. 10.]

The progress made during the past few years in the efficiency of gas-fires and circulating boilers, together with the continued and increasing popularity of the gas-cooker, the high price of coal and uncertainty of the coal market due to strikes, &c., and the acuteness of the domestic servant problem, have combined to make the "All Gas" kitchen range a practical proposition.

Introduction.

When the first illustrations of combined gas-ranges appeared in manufacturers' catalogues some few years ago, the idea of ousting the kitchen range at once appealed to the writer. But the high initial cost of the apparatus, and the inaccessibility of the units for cleaning and repairs, were obstacles to the development of the idea. It then suggested itself to arrange a combination of cooker, boiler, and fire from apparatus already on the Company's hire or hire-purchase list, pull out a kitchen range, and fit them in its place. The consent of the Company's engineer having been obtained, and an order secured from a progressive consumer who was anxious to save labour and be in the van of progress, the first installation was put in hand and duly completed in December, 1913. It has proved satisfactory to both consumer and Company. Eleven complete installations have since then been fitted—four in new houses to order, and seven in place of coal-ranges that have been pulled out and scrapped. In addition, about fifty coal-ranges have been put out of action by fixing a gas-fire in front of the fire-bars, or sealing-up same.

There is not the slightest doubt as to the attractiveness of the proposition from the housewife's point of view; she has never loved the kitchen range as a piece of apparatus, owing to the amount of unpleasant work involved in keeping it in working order. The gas canvasser can score plenty of boundaries on the points of convenience and labour-saving when he suggests the installation of a gas-range and the scrapping of the old coal-range. The first thing in the morning you may put the kettle on the gas-stove and light-up the circulator; and by the time it would take to lay and light the fire in the coal-range, and get it up to working order, you will have a good supply of hot water available and the breakfast cooked.

The ease of control of the gas-cooker is well known to the housewife; but the efficiency of the gas-boiler and the working of the thermostat preventing waste of fuel and maintaining a supply of really hot water available at any moment required, at small fuel cost, is a revelation. All fuel consumption ceases the moment there is no further need for it; and you have no ashes to clean up after, and no "field day" once a week cleaning flues—to say nothing of periodical visits from the sweep. Then the question of boiler cleaning and repairs is undoubtedly in favour of gas.

The gas-fire successfully deals with the question of warming the kitchen in winter and airing clothes. It should be fitted with a fire-guard. It will, I think, be pretty generally agreed (except, of course, by the coal merchants) that gas "has it" on the points mentioned.

Method of Fitting.

We now come to the fitting of the apparatus. In our first installation the method of carrying out the work was as follows. The hot-water system was drained, and the old coal-range and boiler pulled out by the builder; the flow-and-return pipes being cut off at a convenient point above the boiler. The opening was then enlarged to the size necessary to accommodate the new gas apparatus, the fitter in the meanwhile being employed in running the gas supply. The estimated maximum consumption being about 160 cubic feet per hour, a 1-inch supply-pipe was laid from the meter under the kitchen floor across the front of the range opening; a ¾-inch branch across the floor in the centre of the opening supplied the cooker; and another ¾-inch pipe from the end of the 1-inch pipe was extended up the centre of the right-hand jamb to the level of the boiler connection—the pipe being chased-in and a ¾-inch by ¼-inch centre tee left at the correct level for the fire connection. The points were then plugged; and the work being tested by pressure-gauge, the floor boards were re-laid. To support the boiler, two pieces of ¾-inch iron barrel were let into the brickwork at the back of the opening, and fitted with front legs with flanges at the bottom, to ensure a good steady bearing. This stand was so arranged that the base of the boiler should be just above the top of the fire; the latter being raised on a shaped wood stand covered with sheet iron, so that the top was level with, and formed a continuous line with, the crown plate of the cooker. The legs of the boiler-stand were sufficiently wide apart to allow the flue from the fire to pass between them.

The cooker and fire were placed in position temporarily, and packed-up to the correct floor-level, in order to get the measurements for the flue-pipes, which have to be specially made for the job. In the first installation, however, this only applied to the flue from the fire, which was made with an obtuse elbow at the back; the flue being chased-into the brickwork flush, and supported by straps. The boiler was then placed in position, temporarily packed to the correct level, the flow-and-return pipes fitted, and the cooker connected-up *pro tem*. A 1¼-inch by ¼-inch iron bar drilled to take ⅜-inch bolts at intervals of about 1 foot was let into the brickwork at the top of the front of the opening, to support the adjustable register.

The whole of the apparatus was now disconnected and removed, and the floor, sides, and back of the opening rendered with cement, and the chasings stopped. This work completed, and the cement thoroughly set, everything was in readiness for the final stage of the work. The cooker was now permanently connected; the oven supply pipe having been first altered from the right to the left hand side. As the opening in this case was only 39 inches wide, it was necessary to fix the fire right up to the cooker, to keep within the available space. A ⅛-inch iron plate was now fitted on top of the boiler stand; and the left side of the plate was bevelled off to nothing and took a bearing on the crown plate of the cooker—being cut to fit round the brackets. The back and right-hand sides of the plate were fitted close up to the brickwork, and the front edge turned down at a right angle, about 1 inch, to form a level bearing for the back of the fire, which was securely screwed to same. This arrangement entirely closed the whole space on the right of the cooker in addition to making a good stand for the boiler, which was now finally lifted into position, and the flow-and-return pipes, flue, and gas connection fitted.

As arranged, in order to save the cost of tiling, the opening was now lined with sheet iron, which was fitted so as to form a continuation of the front and side walls of the boiler, and entirely encased the boiler connections, flue, &c. The flue from the oven of the cooker and the register having been fitted, and the gas supply connected to the fire, a coat of aluminium paint on the lining completed the job. As may be gathered from the description given, a good deal of scheming and difficult fitting was necessary; and several unforeseen obstacles had to be tackled before we were assured of success.

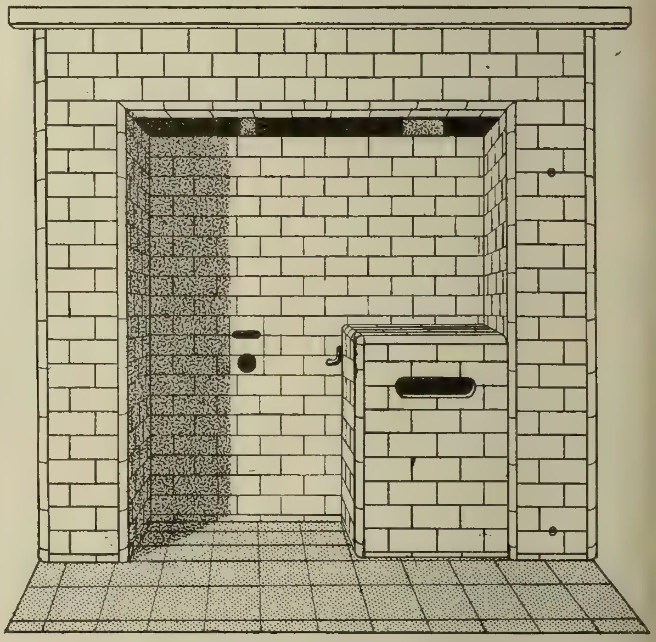


Fig. 1.—Tiling Ready for the Apparatus.

Our later improved installation, with the boiler standing on a tiled brick pier through which passes the flue of the fire [fig. 1], is much easier to fit, and also a much better job, than the close grouped installation; the only advantage of the latter being that it can be fitted in small openings. The method of fixing is substantially the same, except that the sheet-iron lining and boiler stand are dispensed with; the gas supply being arranged exactly as before. Both the oven and fire flues are at the back of the tiling, and are oval in section, to economize space. They are extended about 1 foot above the register; the tops being bevelled off from front to back, and the back portion bent forward to an angle of about 135° to prevent any loose mortar falling into the pipes. The cooker flue pipe is terminated at the lower end by a rectangular box about 1 foot long by 6 inches wide. The lid of this box is fitted outside the tiling, and carries the pipe connecting with the nozzle of the cooker; the bottom of the box being open to serve as an anti-down blow and cleaning door, and incidentally to prevent too great a pull and consequent loss of heat from the oven. Another advantage of the box is, should it become necessary to exchange the cooker, any variation in the height or shape of the flue can be met by fitting a new lid, and so save disturbing the tiles. Figs. 2 and 3 show the general arrangement of the flues and gas supplies completed and ready for covering, and fig. 4 shows a completed installation as now fitted. The dimensions of the opening necessary for this installation are: Width 4 feet, depth 2 feet, height 5 feet. The 4 feet will allow ample room for cleaning on both sides of the cooker.

Troubles, and how they were Overcome.

I am glad to say that, up to the present, complaints in respect of these installations have been practically *nil;* but there were one or two minor troubles which had to be dealt with and overcome that may prove of interest. In passing, I may mention that, from a hygienic point of view, the arrangement is, in my opinion, a great advance; the whole of the products of combustion from the cooker, fire, and boiler passing away cleanly into the chimney, in addition to the greasy vapours given off in the process of cooking. The adjustable opening in the register above the hot plate of the cooker proved very successful in dealing with the waste gases from this source.

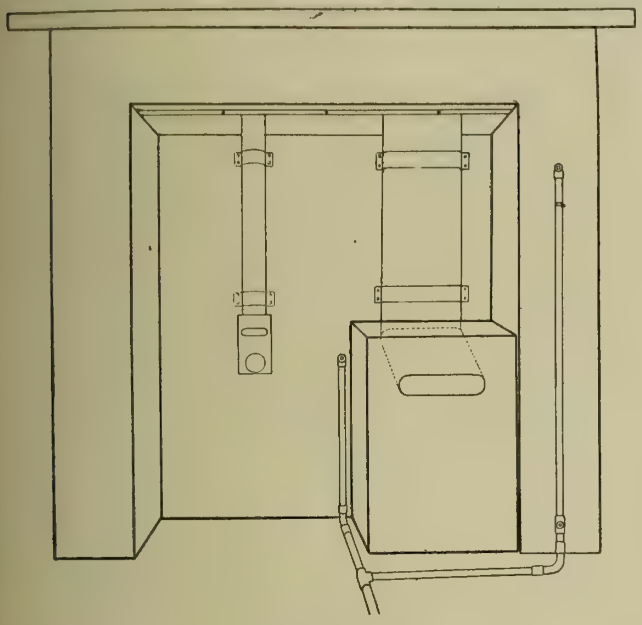


Fig. 2.—Arrangement of Flues.

It was, perhaps, owing to the pull on the flues being rather excessive that we experienced our first trouble—viz., the circulator burner being put out after the thermostat had come into operation. This happened at intervals; and from the first we attributed the trouble to the keen draught, which, of course, varied with the weather. We increased the amount of gas passing through the bye-pass, and drilled holes in the sheet-iron boxing, in order, by bye-passing some of the air, to ease the pull through the boiler, at the same time opening the register to the full extent. The trouble, however, continued. Finally, we tackled the chimney-pot, and by cementing a flower-pot into the chimney-pot (an old dodge) we found we had practically stopped the updraught altogether. Then, by gradually enlarging the hole in the bottom of the flower-pot, we succeeded in getting sufficient pull to remove the products of combustion without excessive draught; and there has been no further complaint of the bye-pass being extinguished. This trouble occurred on two separate installations; the same remedy proving successful in each case.

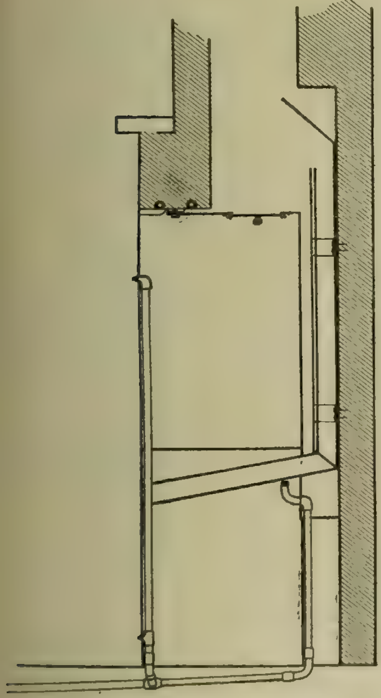


Fig. 3.—Flue and Gas Connections.

Another of our troubles was a little problem in hot-water work, which announced itself during testing operations after the completion of the installation. I may here digress for just a moment to remark that the advent of the gas circulating boiler seems to have exposed some defects in hot-water systems that were previously not suspected, and emphasized others. The vagaries of intercirculation are now well known, with the shutting-down of the thermostat when the gas-boiler is out of action. In spite of this, I believe illustrations are still abroad showing how conveniently a gas circulator can be connected to the existing flow-and-return pipes from the range-boiler, by right-angle tees, fitted about 6 feet away from the kitchen boiler to the vertical pipes in the chimney-breast recess. While on the subject of connecting to existing flow-and-return pipes, it should not be overlooked that, where a gas-boiler is so fixed and the draw-offs are from the flow-pipe, if the range-fire is out, mixed water is quite likely to be drawn.

To return to my subject. The installation in question comprised a 35-gallon rectangular hot storage tank, which was fixed in an attic on the second floor, almost immediately over the kitchen. The 1-inch cold supply entered this tank at the side quite close to the bottom, without being properly trapped. The cold storage tank was fixed almost immediately over the other.

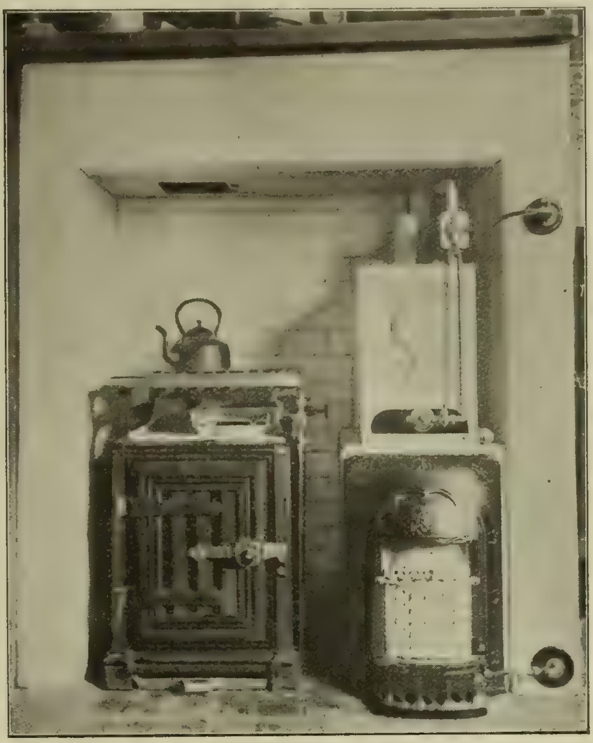


Fig. 4.—Combined Gas Cooker, Boiler, and Fire Installation.

There was about 50 feet of 1¼-inch flow-and-return pipe, nearly all of which was rising vertically, to within about 4 feet of the tank, from which point it was almost level. From the flow-pipe, about 4 feet above the boiler, there was a secondary ¾-inch circuit heating a radiator in the linen cupboard, and returning again to the flow-pipe; one tee being fixed just above the other. The draw-offs were all taken from the expansion-pipe. The gas-boiler fitted was adjusted to consume 80 cubic feet of gas per hour.

On lighting-up the boiler, all went well. The flow-pipe became very hot, the whole of the storage was heated in good time, the circulation completed, and the thermostat shut-down, and we thought the job was finished. A few gallons of water were then drawn off to test the thermostat; but there was no sign of the gas coming on again. To make a long story short, we could draw the whole 35 gallons of hot water, and the return pipe was, if anything, hotter at the end of the draw than before. The cold water simply defied the law of gravitation, and would not come down. The thermostat we knew to be in order. On testing the water in the cold storage tank, I found it to be 70° Fahr., or about 10° higher than it should have been, due to the untrapped cold supply to the

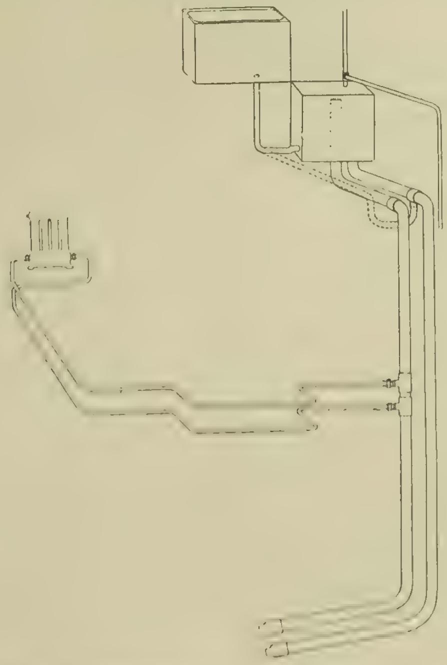


Fig. 5.—Details of Hot-Water Installation.

hot storage. But this would not account for the trouble. The man-hole lid having been removed from the hot tank, the flow-and-return connections were found in order; and as there was no doubt the return pipe continued to get hotter, suspicion fell on the boiler, which it was thought might have reversed the circulation in some mysterious way. Another theory was that, with such alarge amount of 1¼-inch vertical pipe already hot and the circulation suspended by drawing off, the upward pressure was overbalancing the downward pressure of the cold water and thus preventing it descending.

To decide the matter, the boiler was at once exchanged, being charged with the offence. But on the new boiler behaving in exactly the same manner, the suspect was discharged without a stain on its character. The 1-inch cold supply was now cut off from the tank, trapped, and teed into the 1¼-inch return pipe, and upon re-testing the cold water at once descended after the drawing-off of about one gallon, and the thermostat responded. In face of this result, I shall be interested to know if any gentleman can support my second theory; if not, can he enlighten me as to the cause of the trouble? There is in my mind no doubt that this phenomena existed when the range boiler was in use; but it was the gas-boiler, or rather the thermostat, that exposed the fault. Fig. 5 shows the details of the hot-water installation in question.

Initial Costs of Installation.

We now come to the financial aspect of the question, and, as in all commercial propositions, there are the important points of initial and working costs, repairs, and depreciation.

Builder's Work.—Pulling-out the old kitchen range and boiler, cutting-off flow-and-return pipes, doing necessary cutting-away of brickwork, building-up around flues and stand for boiler, rendering and tiling opening, floor and jambs. This will vary somewhat with the size of the opening, and costs from £4 to £5. In new buildings, of course, the cost of pulling-out the old range and cutting-away is saved.

Fitter's Work.—Laying gas supply pipes, fitting cooker, boiler, and fire, making and fitting special flues for same and adjustable register for opening roof, connecting boiler to existing flow-and-return pipes (assuming same are properly installed), altering draw-offs from flow to expansion pipe if necessary, making good, and testing. [In new buildings the flow-and-return pipes were run and connected to the storage tank. The draw-offs and the rest of the hot-water installation, including the fixing of the tank, was done by the builder's plumber.]

The average net cost to the Company of the above fitting work was, taking the average of three installations, in new buildings, £4 1s. 8d. each; and in two cases in which the coal-ranges were pulled out, £5 11s. 10d. each. Thus, adding the builder's and fitter's work, the net fixing costs of an installation to the Company were: In new buildings, approximately, £8 8s.; in cases where coal-ranges were pulled out, £10 10s.

Costs of Cooker, Boiler, and Fire.

The costs of these will, of course, depend on the apparatus selected, and may therefore vary greatly. But we have not in any of the combined ranges installed the cheaper two-section boilers, or one burning less than 60 cubic feet of gas per hour. The net cost of the appliances shown—viz., a four-section boiler, with gas consumption of 60 cubic feet per hour, an intermediate grade cooker with 14-inch oven, three boiling burners and grill, and a 10-inch gas-fire, would be approximately £9 4s. But, as previously stated, this will vary according to the individual consumer's requirements.

The initial net cost of the installation and fitting, based on the above figures, will therefore be:

In new buildings (say)	£17 12
In cases where coal-range is displaced	19 14

Compared with the above, it would cost a consumer from £10 to £12 to pull out a 3 ft. 6 in. kitchen range and instal a new one.

For big families a larger cooker is advisable, as there will be no kitchen range available; and in cases where over 30 gallons storage of hot water are required, I think it would be advisable to instal a boiler consuming 80 cubic feet of gas per hour. But with gas, if the boiler is large enough, such quick results are obtained that for ordinary domestic use in villa residences—with (say) draw-offs supplying one bath, two lavatory basins, and scullery-sink—30-gallon storage should prove ample; and should the storage exceed this, it would pay to cut it down by altering the return pipe connection to the tank by the now well-known method. In deciding the size of boiler, any secondary flows and returns, towel-rails, &c., should be noted and allowed for, if they are to remain in action. It must not be forgotten, however, that they mean increased heat loss, and consequently a higher consumption of gas. An independent gas-heated, towel-rail, or, where convenient, a draw-off taken through the rail, would be advisable. The case of a coil heating a linen cupboard, where the storage tank is elsewhere, is, of course, important; and care must be taken to see that it works efficiently.

Working Costs.

In the following figures of the working costs of installations, every care has been taken to ensure the information being as accurate as possible. The figures of the gas consumptions are, of course, exact, being taken from the meter-cards; but, in some cases at least, circumstances affecting the ordinary routine of the household discount their value. This is, unfortunately, impossible to avoid in making comparisons from year to year. It must also be remembered that at the present time people are keeping a closer watch on expenditure, and studying economy more closely than they did before the war. In the figures relating to coal consumed, the information was obtained direct from the consumer; and where not taken from actual invoices, it is given as "approximate consumption."

Consumer A.

Four in family, including maid.
Approximate rent of house—£45 per annum.
Appliances—combined range and Kern radiator in dining room.

	Cubic Feet.
Gas consumed per annum in 1912, previous to installation of combined range	28,600
Gas consumed per annum in 1914, after installation of combined range	49,900
Increase per annum	21,300

at 3s. per 1000 cubic feet = Increase in gas account of	£3	3	11

Coal used in 1912, 3½ tons per annum approximately.
,, ,, ,, 1914, 1½ ,, ,, ,, ,,

Coal saved equals 2 tons per annum approximately.

Say, 2 tons at 30s. = saving in coal account of	£3	0	0
Saving in repairs to boiler, sweep, wood, &c., say	1	0	0
Total saving	£4	0	0
Less	3	3	11
	£0	16	1

Remarks.—Circulator only used one day each week. Exceptionally careful consumer. This would, of course, apply to coal as well as gas.

Consumer B.

Seven in family.
Rental of house—£75 per annum.
Appliances—combined range and two 10-inch fires.

	Cubic Feet.
Gas consumed previous to installation of combined range Midsummer, 1912, to 1913	11,000
Gas consumed after installation of combined range Midsummer, 1914, to 1915	98,200
Increase per annum	87,200

at 3s. per 1000 cubic feet. = Increase in gas account of	£13	1	7

Coal used in 1913 . . . 10 tons per annum approximately.
Coal used since installation of combined range . . 1½ ,, ,, ,,

Coal saved per annum . . 8½ tons per annum at present prices.

Say 8½ tons at 30s. = saving in coal account of	£12	15	0

Increase in gas account	£13	1	7
Saving in coal account	12	15	0
Extra cost of gas	£0	6	7

Remarks.—Against the extra cost of 6s. 7d. must be placed the saving in boiler repairs, sweep, wood, &c. (say) £1, leaving a small balance in favour of gas. In the case of consumer B, two servants have been dispensed with since the combined gas-range has been installed. On the other hand, the consumption of coal given for 1913 was considered by the consumer to be rather abnormal, being due to lavish use by the servants at a period when they were not under usual supervision. Since the servants were dispensed with, the gas-range has been used by the consumer regularly; and the excellent results obtained are undoubtedly due to careful management. This, however, only shows what can be done by gas when it is used intelligently; and I submit that the figures given are eloquent in its favour as a domestic fuel compared with coal, after all allowances have been made.

Consumer C.

Four or five in family, including maid. Often have company.
Rental of house—£65 per annum.
Appliances—Combination range (installed 29/10/14*) 18-inch "Condor" fire lighting in kitchen, scullery, &c.
Gas consumed 1913: 32,100 cubic feet.

		Cubic Feet.
Gas consumed 1914.	March	15,300
	Midsummer	5,400
	Michaelmas	2,200
	Christmas	23,300*
		46,200
Gas consumed 1915.	March	43,200
	Midsummer	24,200
	Michaelmas	21,500
	Christmas (Estimated)	37,100

Say, 126,000 cubic feet per annum.

126,000 cubic feet.
32,100 ,,

93,900 cubic feet increase over 1913. Say, 94,000 cubic feet at 3s.=

£14 2s. 0d. increase in gas account.

Coal used 1913-1914, 10½ tons per annum approximately.
,, ,, 1914-1915, 2 ,, ,, ,, ,,

Coal saved . . . 8½ tons per annum at present prices.

Say, 8½ tons at 30s. = saving in coal account of	£12	15	0

Increase in gas account	£14	2	0
Saving in coal ,,	12	15	0
Extra cost of gas	£1	7	0

Remarks.—From this extra cost of £1 7s., at least £1 must be deducted for cost of firewood and chimney sweep's charges, which, assuming no repairs to boiler were to be met, shows the additional cost of gas over coal to be only 7s. per annum, while the extra convenience and labour saved are worth quite ten times this amount to the consumer. The consumer reports the installation as being very satisfactory. He has shown it to many friends, who are only prevented from adopting similar arrangements by the initial outlay necessary. He also says the old range was very wasteful; and he could not get hot water before adopting the gas-boiler. He was unable to have a second bath for hours after the first. The cooker is used regularly for three meals daily.

CONSUMER D.

Five in family, including servant.
Rental of house—£55 per annum.
Gas used throughout for cooking, hot water, and heating. No coal used. 15 per cent. discount.
Appliances.—Two geysers (one large and one small lavatory type). Cooker. Eleven fires (three 14-inch, one 12-inch, and four 10-inch). 21/9/14.*

		Cubic Feet.
Gas consumed 1912.	Ladyday	10,400
	Midsummer	13,400
	Michaelmas	8,300
	Christmas	9,700
		41,800
Gas consumed 1913.	Ladyday	12,400
	Midsummer	10,800
	Michaelmas	13,100
	Christmas	6,300
		42,600
Gas consumed 1914.	Ladyday	16,100
	Midsummer	15,200
	Michaelmas	10,200
	Christmas	60,600*
		102,100
Gas consumed Christmas, 1914, to Michaelmas, 1915.	Christmas, 1914	60,600*
	Ladyday, 1915	52,600
	Midsummer, 1915	26,700
	Michaelmas, 1915	11,200
		151,100
	Less	42,600
	Increased gas used	108,500

108,500 cubic feet at 3s. 4d. per 1000 cubic feet less 15 per cent. discount = £15 7s. 5d. increase in gas account.
Actual coal used per annum in 1913, 16 tons, which at 30s. per ton = £24 per annum for coal saved.

	£	s.	d.
Decrease in coal account per annum	£24	0	0
Increase ,, gas ,, ,, ,,	15	7	5
Saving per annum	£8	12	7

Against this must be placed the account for hire and hire-purchase of appliances on the one hand, while on the other we have again to allow for firewood, sweep's account, &c., saved.

Remarks.—The coal-range was a very extravagant one. Two servants less since coal was dispensed with; consequently no heating of kitchen necessary.

Comparison of Charges.

Interest on capital outlay at 10 per cent. per annum, and repairs and depreciation, as an annual charge.

GAS INSTALLATION.

	£	s.	d.
Interest on (say) £20 at 10 per cent. per annum	2	0	0
Repairs and depreciation—			
Based on life of boiler, 10 years, per annum. ,, ,, ,, cooker and fire, 20 years, per annum	1	0	0
Giving an annual charge of	3	0	0

COAL-RANGE.

	£	s.	d.
Interest on £10 at 10 per cent.	1	0	0
Repairs and depreciation—			
Based on life of range, 30 years. ,, ,, ,, boiler, 10 ,,	0	15	0*
Giving an annual charge of	1	15	0

* This figure would probably be much higher in hard-water districts.

To Summarize

The initial cost of the gas installation is higher than the kitchen range.

Working costs.—Judged on the figures I have been able to obtain, gas will, to say the least, compare very favourably with coal.

Depreciation and repairs.—Though in the figures above, the kitchen range has been given the benefit of the comparison, this item is such an uncertain quantity, it would have perhaps been wiser to leave it entirely alone. In some cases undoubtedly this item alone will be sufficient to cause the scrapping of the kitchen range, as was the case in one of the installations mentioned, in which the bill for repairs to kitchen boiler and pipes amounted to £19 in twelve months.

Benefit to the Gas Company.—Regular increased consumption.

Benefit to the consumer.—Great saving in labour, greater convenience, and cleanliness.

SPECIAL DISCOUNTS.

The Company I serve, in order to foster the movement, are allowing the consumers under a special agreement a discount of 10 per cent. off the whole of the gas consumed on the premises where all the hot water is obtained and the cooking done by gas exclusively, the kitchen range being either removed and a gas-fire fitted in front, or the range sealed-up, as before mentioned. In cases where gas-fires are fitted to every grate and no coal or solid fuel whatever is used, the agreement allows 15 per cent. discount.

I have to acknowledge, with thanks, the assistance of one of my fitting staff (Mr. Ernest Allen), who, in addition to being responsible for the photographs and drawings shown, carried out the actual fitting of our first installation. In conclusion, may I say: "Use Gas! Less Labour. Greater Comfort."

DISCUSSION.

The PRESIDENT (Mr. S. B. Chandler, of the South Suburban Gas Company) having invited discussion of the paper,

Mr. W. E. BROWN (Gas Light and Coke Company) remarked that the author had dealt with a subject which was every day before the distribution department. It seemed to him that more might often be made by gas men of the point about the unpleasant job of cleaning the flues of the kitchen range. Frequently servants refused to take a place where they would have to clean the flues of the kitchener; and now that domestics were so hard to obtain, this point should be emphasized when trying to get a gas installation in. For such installations as the author described, it would probably be necessary to confine one's self to cases where the house was the occupier's own property. He could hardly think people with a three years' tenancy would go to the expense, because the landlord might require them to put back the coal-range when they left. A gas-fire in a kitchen was, of course, very nice; but he wondered how Mr. Westbrook found consumers who were prepared to allow servants the use of a gas-fire in the kitchen. Most mistresses would be inclined to regard this as somewhat of a luxury. No doubt, if they did away with the coal-range, they must have some means of warming the kitchen; but it seemed that gas-fires would be rather extravagant for long-period consumption like that—from early morning to late at night. With reference to fig. 5, Mr. Westbrook said he had converted this installation to the cylinder system; but when they referred to conversion to the cylinder system, it generally meant a case where the storage tank had been brought down to the level of the boiler. He did not say the author's was not actually a cylinder system; but could he not have brought the tank downstairs, and saved the flow and return? Some of the consumptions mentioned in the paper, for the number of fires and other apparatus in use, appeared to be very light. There was one case with eleven gas-fires, where some gas might be expected to go through. He supposed the meters were all right.

The PRESIDENT remarked that the servant trouble certainly increased the importance of the subject under discussion. Mr. Westbrook's idea was to be commended; and he thought every one would agree that, as shown by the drawings, the installation looked well. Doubtless, also, it carried out all its functions to the full. The paper was not one that lent itself to a great amount of discussion. The author had put before them a simple statement of facts; and they were very grateful to him for the trouble he had taken in so doing.

Mr. F. AINSWORTH (Ilford) said reference was made in the paper to matters which were of particular interest to him. Mr. Westbrook, in connection with his gas installations, described a method of dealing with the ventilation at the top of the building; but he (the speaker) did not know whether this could always be a success. Possibly the building referred to was a low one; and, if so, would the author recommend the same course in the case of lofty premises? Could he not arrange for the ventilation to be dealt with lower down, by adopting a damper immediately above the apparatus, so that the draught could be regulated as required? This might save a certain amount of trouble which perhaps would otherwise arise. Again, did the author recommend a 35 gallon tank for hot water? His own experience was that the larger the storage, the less satisfactory it was. For an ordinary house, he thought 20 gallons was quite sufficient; and it would be much more economical. A friend of his had an idea that he would like to have plenty of hot water, and he went in for a 40-gallon system; but it cost him so much that he afterwards had it changed for a 20-gallon one. In connection with one of his installations, he (Mr. Ainsworth) had met with a difficulty which might have some bearing on the paper. The piping of a hot-water service had been renewed only twelve months previously; and yet the people could not get sufficient hot water. He saw the consumer, and suggested that he should have a circulator put in; and this was done by connecting it in the ordinary way to the inlet and outlet of the boiler. It appeared at the time to give satisfaction; but the consumer soon found that he did not get hot water quickly enough. An investigation was then made, and it was discovered that the pipe had got coated up. The iron pipe was therefore taken out and replaced by a lead one; and this proved a success. He remembered an instance of a large shop, where the pipes did not appear to be laid properly, so they arranged with the builder to relay them; and in another case the cold water was run too high into the tank. The paper dealt with a promising branch of business; and it would pay gas companies to put in these installations at very much less than cost, until people got to know the value of them. He fully expected the future of gas to be more prosperous than the past; and he believed they would be able to get these things to a more economical point than was possible at the present time. He had come across a case in his district, where the people had got an electric cooker free of cost as far as the rent was concerned, and then they found it too dear to use.

Mr. Westbrook, in replying to the points raised, said that, of course, the ownership of the house was an important point in connection with obtaining an order for one of these installations. If the occupier was not the owner, he had to try and bring the landlord up to the scratch. In some cases where the tenants had been fairly well off, they had done the thing themselves. In other instances, tenants had brought their landlords along to the showrooms, and there had been an arrangement as to sharing the costs. They had not really found much difficulty in this way; but, of course, the initial cost of the installation was one of the principal drawbacks. The cheaper gas undertakings could see their way to put them in, the greater would be the inducement to adopt them. In regard to the servants' fire, undoubtedly a gas-fire going all day was something of a luxury; but when a room was once properly warmed, it did not take much gas to keep it at a comfortable temperature. The fires were fitted with loose keys, so that the mistress could keep complete control of them; and, of course, it had to be remembered that during a great part of the day a servant was moving about at her work, and so did not require a fire. The cylinder system of water heating, he took it, meant where the draw came off the expansion-pipe. The reason they did not bring the tank down was that in this particular case there did not happen to be any convenient place in which to put it. Another thing was that one had to be very careful in moving these tanks down to a lower level. The builders put them in so light that very often they would not stand the extra pressure.

Mr. Brown: Generally we leave the tank where it is, and put in a cylinder at the bottom.

Mr. Westbrook remarked that, in addition to the fact that, in the case referred to, there was not the chance of doing this, it would, of course, increase the expense. With regard to the consumptions shown, he explained that in one case the user was particularly careful. He thought that the consumption in the installation with eleven fires was a fairly reasonable one. There was an increase of 100,000 cubic feet, which was a good figure for a house of that size. Mr. Ainsworth had referred to possible difficulties in regulating ventilation at the top of the building. All the installations were fitted in ordinary villa residences. It was suggested that the matter might be dealt with by means of a damper down below; but in this case they would have to damper three flues, instead of one at the top. Any dampering there was should be done carefully. The excessive draught was due to everything being closed-in. As to preference for 20 or 30 gallons storage, cases had, of course, to be considered on their merits. For instance, one would not think of putting a 20-gallon system in with two baths. Where it was for 30 gallons, he recommended cutting-down for villa residences. He took it that, lead pipe having a smoother surface, the furring-up was not such an easy process as was the case with iron. Of course, the cold water was always kept as low as possible in its entrance to the tank.

Mr. C. Tanner, sen., who proposed a hearty vote of thanks to Mr. Westbrook for his paper, expressed regret that ill-health had prevented him lately from attending the meetings of the Association as frequently as he would have liked, and remarked that the same cause had compelled his retirement from the position of Works Superintendent at Gillingham.

Mr. Ainsworth, in seconding, urged that the juniors would greatly benefit themselves by attending as many of the meetings as they possibly could, and taking part in the discussions.

Mr. Westbrook acknowledged the vote.

Gas Coke as Fuel.

Striking facts with regard to the economy of steam-driven motor waggons, with the use of graded gas coke as fuel, are contained in a handy-sized booklet on "The Fuel Problem" issued by the London Coke Committee. The figures quoted prove that wherever graded gas coke can be purchased at under 90 per cent. of the price of good quality Welsh coal, the former is the more economical fuel. This point being ascertained, the next step is to find out where this desirable fuel is to be obtained; and here, again, the booklet offers valuable aid, inasmuch as it contains a list of 200 supply depôts where graded gas coke is stocked for the convenience of steam-motor users. The list renders the booklet an exceedingly useful addition to the equipment of steam-motor drivers—which usefulness is further enhanced by some practical hints on firing gas coke. Free copies of the booklet are, it may be mentioned, available to steam users, on application to the London Coke Committee, at No. 84, Horseferry Road, Westminster. Drivers who may, when out, require a fresh supply of fuel, and have not the printed list of depôts handy, must look out for a green and white sign-plate bearing the words "Motor Coke," which indicates wayside supply depôts where graded gas coke is stocked for the convenience of steam-motor users. By the way, the London Coke Committee are also issuing a pamphlet on "Fuel Economy in Dyeing, Cleaning, and Laundry Work." For these purposes, gas coke is a highly desirable (because it ensures smokeless combustion, which is so necessary in these industries), as well as an economical, method of raising steam.

* * *

A paper, entitled "Notes on the Ignition of Explosive Gas Mixtures by Electric Sparks," will be read by Mr. J. D. Morgan to-morrow (Wednesday) evening at Birmingham before the local section of the Institution of Electrical Engineers.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

The second meeting of the curtailed session of the Scottish Junior Gas Association (Western District) was held in the Royal Technical College, Glasgow, last Saturday—the President (Mr. David Fulton) in the chair.

The Interim Hon. Secretary (Mr. Malcolm Littlejohn) intimated that Mr. W. M. Mason, the Secretary of the British Commercial Gas Association, had forwarded a complete set of the literature published by his Association for the use of members.

A Loss to the Association.

The President referred to the great loss the Association had sustained in the death of Lieut.-Colonel Henry O'Connor. There was hardly a member of the Association who had not gone through his classes in that college, and had greatly benefited thereby. It was agreed to send a letter of condolence to the widow.

Mr. E. Stroud, of the Holophane Company, read a paper, illustrated by lantern slides, on

MODERN ILLUMINATION AS APPLIED TO GAS LIGHTING.

The author began by referring to the recent report of the Departmental Committee on Lighting in Factories and Workshops, some of the recommendations contained in which he quoted; and then he proceeded to discuss the means by which these recommendations could be carried out. He remarked that a statistical inquiry into the number of accidents during each month throughout the year points to the conclusion that inadequate lighting is a contributory cause of accidents. Complaints of eye strain, headache, &c., attributed to insufficient lighting, are common; and there is a general impression that unsatisfactory lighting is, in various ways, prejudicial to health. It is also recognized that insufficient light adds to the difficulty of the proper supervision of work and of the maintenance of cleanliness and sanitary conditions generally.

With reference to the recommendations as to the minimum intensity of illumination required for safety, he said it had been pointed out that this was an absolute minimum permissible in the darkest places, and that the illumination at most other parts would be very much higher. At the same time, he would suggest that the most important consideration was the contrast of illumination, and that a ratio should be fixed maximum to minimum in any one shop. It would easily be seen that a man working on his lathe with a local light giving (say) 20 foot-candles on the machine, and looking or moving away to the relative obscurity of 0·5 foot-candle illumination, was liable to stumble and fall over any obstruction which might be in the way. With the present high-power sources and modern methods of distribution, it is possible to get an extremely even and efficient illumination at very small cost; and he thought that a general illumination of 1 to 1·5 foot-candles should be allowed for, besides local lighting. He would also suggest that, in addition to the periodic cleaning of windows for natural lighting, a periodic cleaning of the lighting units should be enforced, as it was quite possible to get a considerable reduction in illumination after the units had been installed some time, by excessive dirt on burner or reflector.

Continuing, Mr. Stroud said it would be noticed that in the Committee's report all numerical recommendations are made in terms of foot-candle values; the foot-candle being the unit of intensity of illumination as distinct from the candle power of the source, the candle power being the unit of intensity of light.

Light is the cause, illumination is the effect. Bearing this in mind, it will be seen that, before it is possible to make an installation with any degree of certainty of result, one must know the performance of the unit proposed. There is, of course, the cut-and-dried method of installation, experience, and also the allowance of excessive candle power—all of which fail in the essentials of adequacy, economy, and certainty of which installations can be made with predetermined and fixed illumination values necessary for different classes of service.

By using different types of reflectors, any form of distribution can be obtained, varying from concentrating to extremely extensive. It is certain that very poor results could be obtained by using an incorrect distribution for a specific purpose; and it is equally certain that tremendous advantage and economy are to be effected by being able to alter at will the distribution of the bare source to suit any particular problem.

The distribution or polar curve is the graphic representation of the light distribution. The intensity of light is taken for various angles in a vertical plane through the lamp axis, and plotted in terms of candle power, conveying a clear idea of the manner in which the light is emitted. These curves really represent solid angles or cones of light. It is a popular fallacy that the area included by the vertical distribution curve is a measure of the total flux emitted by the source. This is entirely erroneous, as, of course, the curve of the reflectors (which are greater in area than the bare source), cannot, of necessity, have a greater quantity of flux of light than the original source. In fact, in every case, the total flux in the reflector combinations is less than the bare source by the absorption of the reflector. I have a slide which shows three possible vertical distributions, each representing the same flux of light; and to make this important point more clear, the next slide shows a simple illustration of a ball which has a white disc on the bottom which represents a 10° zone in a vertical plane, and a number of white discs of the same diameter around the circumference, the whole of which represents a 10° zone in the horizontal plane.

This flux of illumination, which is measured in lumens, is equal to the intensity of illumination (foot-candles) multiplied by the area over which it is distributed. Therefore, a source of 1-candle power illuminating an area of 1 square foot with 1 foot-candle intensity would be equal to one lumen. Similarly, a source of 1-candle power intensity in all directions placed in the centre of a hollow sphere of 1 foot radius would illuminate the inner surface with an intensity of 1 foot-candle, giving a total lumens of 12·56, since the area of a sphere is found by multiplying the square of the radius by the constant 4π (12·56).

To calculate the mean spherical or mean hemispherical candle power from the distribution curve, it is required to know the total lumens emitted either in the whole sphere or hemisphere under consideration, and divide by 4π (12·56), or 2π (6·28) respectively; and to find the total lumens emitted it is required to take the average candle powers of the different zones and multiply by what are called the "zone factors." It is usually convenient to figure for zones of 10°, and sufficiently accurate to assume that the candle power at the centre of each 10° zone represents the average candle power of the zone.

The following are the factors which such candle power values should be multiplied by to give the lumens in each 10° zone.

Zone.	Factor to Obtain Lumens from Average Candle Power.
0 to 10	0·0954
10 ,, 20	0·283
20 ,, 30	0·463
30 ,, 40	0·628
40 ,, 50	0·774
50 ,, 60	0·897
60 ,, 70	0·992
70 ,, 80	1·058
80 ,, 90	1·091

Above 90° the factors are the same, but of the reverse order.

To use these factors with the curve of any light unit, take the candle power at 5° and multiply by the 0° to 10° factor to obtain lumens in the 0° to 10° zone; take the candle power at 15° and multiply it by the 10° to 20° factor, &c. The total lumens for any large zone is the sum of the lumens thus determined. The total of the factors 0° to 180° being equal to 4π (12·56) the area of a sphere.

The reason will be seen why it is possible to obtain an extreme concentrating reflector to give an end-on candle power many times the rated horizontal candle power of the source. As with (say) 1000-candle power over the 10° vertical zone gives 1000 × 0·1 = 100 lumens; but with only 100-candle power in the horizontal 10° zone, we get approximately the same quantity—viz., 100 × 1·1 = 110 lumens.

Every lighting unit should have such a curve supplied with it, which would show the engineer the distribution he would get, and whether such a distribution is the most suitable, and also enable him to calculate the height to place the units, and the distance apart, to obtain even distribution (if required), after having decided the foot-candle intensity that is necessary for the particular problem in hand.

There is a slide which shows a distribution curve coupled with the illumination curve. It illustrates the method of calculating the illumination curve, and also the formula necessary. But I do not propose at this stage to deal fully with illumination curves, spacing of units, &c. The plan adopted in this case is called the point-by-point method; and neglecting the reflection from surroundings, the resultant illumination can be determined with considerable accuracy. In practical problems, the "effect of surrounding" is important as to the resultant illumination obtained. Naturally, reflection conditions vary widely in practice; and it is impossible to give values which are of universal application. Should the reflector be opaque, no light will reach the upper hemisphere, and therefore no reflection will be obtained from the ceiling and upper portion of walls.

With "Holophane" reflectors an increase in the actual illumination over that calculated by the point-by-point method is as follows.

Condition Ceiling.	Condition of Walls.	Per Cent. Increase over Calculated Illumination.
Very dark	Very dark	0
Medium	Very dark	15
Medium	Medium	40
Very light	Very dark	30
Very light	Medium	55
Very light	Very light	80

In conclusion, Mr. Stroud drew attention to the "Lumeter," and threw on the screen some slides of recent examples of gas lighting.

DISCUSSION.

Mr. John Colquhoun (Glasgow) asked if the lumeter was an accurate instrument. If it was not accurate, what degree of inaccuracy must one allow for it? He was interested to see that the photometer which Mr. Stroud put on the screen entailed an arrangement of mirrors. What allowance was made for the absorption of light by the mirrors? And what about dust? The table giving the percentages of reflection from wall surfaces ought to be printed broadcast, and given to painters and decorators. This matter of reflection was one greatly neglected in houses, churches, and other buildings.

Mr. J. M'Ghie (Glasgow) said if he was not mistaken, Mr. Stroud's Company set out to get the maximum amount of light on the object, not on the eye. He believed this was one of the claims of the Holophane light. He had been using Holophane glassware for some time. He had, however, fitted up an office frequented by gas men with the extensive Holophane shade. But the men preferred to go back to the full, clear globe—chiefly because they had not become accustomed to the benefits of the diffused light. He discovered that the principal objection, however, was the greater quantity of dust that collected about the Holophane prisms and corrugations as compared with that which collected on the ordinary globe. This was a matter, of course, of keeping the shades in order. The second question was one of expense. Unfortunately, though the ordinary consumer seemed to spend money like water on certain things, he would not go to the expense of Holophane shades. The new glass shades that were coming from America were going to be a serious rival. Personally, he believed in semi-indirect lighting. He was consulted a few years ago about the lighting of a large drawing office, which eventually went in for indirect lighting. He was sure, however, that if they were reconsidering the matter they would instal semi-indirect lighting. He had never experienced the slightest eye-fatigue from semi-indirect lighting. Dealing with the Home Office Committee's findings, to which Mr. Stroud alluded, he thought it a waste of labour to set up any laws regarding the lighting of workshops and factories. If a scheme of standardization or of issuing a certificate by a national laboratory regarding the types of lamp were adopted, it would help the work of the engineer. It would be quite a simple matter for him to fix his lighting on the principle of going on a basis varying according to the need of the work from (say) 0·50 candle up to as high as 2 candles per square foot of floor surface. All these systems had to be used with a very large amount of common sense. A man might have the tables at his finger ends; but unless he used common sense he might as well throw them away. With regard to shop lighting, one could see a shop artistically lighted, but the whole effect was spoiled by a neighbour putting up arc lamps. If there was a law to prevent building that destroyed another's site, why should not the same apply in the matter of lighting? No large power lamp should be allowed outside a shop without an adequate shade on the street side of the lamp. This was a thing that ought to be insisted upon by the law authorities all over the country.

Mr. John Wilson (Falkirk) was not quite clear about the remark made by Mr. Stroud on the ratio of maximum and minimum illumination. Did he mean thereby to eliminate the bad effect of contrast? He had had an experience two years ago in a works well lit with regard to the working parts, while the passages were lit on the standard required by the Factory Act. But, owing to the contrast, the latter appeared dark. Accidents had happened in this way. Was there anything in the scheme the Departmental Committee had put forward which would eliminate this? It was possible to get 25 per cent. better lighting by keeping globes clean. The "Lumeter" was worked by an accumulator. He took it that the instrument should be standardized before going out to make tests. Was it necessary to standardize it when one came back, and make allowance because of loss of voltage in the accumulator? Personally, he did not see how the accumulator could give constant voltage. There might be much in this. One forgot that illumination was a different thing from light. It was only lectures such as they had had that night which freshened them up and made them think about these things a little more clearly.

Mr. Malcolm Littlejohn said Mr. Stroud had dealt with what was generally accepted as correct. He was glad to see he had emphasized the matter of contrast. One could not be too particular about contrast. They had had examples in the streets where too brilliant a light meant that one seemed afterwards to be going into darkness. The same effect was experienced in a dark road after meeting the bright head-lights of a motor-car. He was not much in favour of dealing in lumens. The calculation of illumination on the horizontal plane was quite complicated enough without dealing with the question of lumens. The polar graff was quite sufficient for all practical purposes. Now that, with gas sources, the candle power in each direction was the same, there was no necessity to get lumens and complicate the calculations.

The President, in calling on Mr. Stroud to reply, said that the science of illumination had been neglected by gas engineers. They were only now beginning to realize that it was a science. Perhaps the best thing of which they could assure Mr. Stroud was that he had increased their knowledge. It was to be regretted that the price of glassware was so high.

Mr. Stroud admitted, in reference to the use of the photometer that there was absorption due to the mirrors; but in the ordinary tests it was more a matter of comparison—one lamp with another. They knew, however, the absorption due to these mirrors when clean, and could calculate accordingly. He also thought there should be some standardized rating of lamps, and that there should be certain provision made with people to rate their lamps, whether in lumens or not. If one lamp was so many lumens and another so many lumens, one could compare. Other than this there was no real way to compare. One maker boasted of 1000-candle power, and another gave the power of his lamp as 100-candle power; and perhaps the latter was giving the greater quantity of light. Regarding the lumeter, provided it was charged properly, it was accurate within 5 per cent. Usually the instrument was used for comparative tests; and there it was correct always. In reference to Holophane shades and the question of dust—it was an old sore. People said they had a large surface area and held dust; but, at the same time, Holophane reflectors suffered less difference with dust than ordinary shades. Dry dust did not affect the prism at all. The trouble was when they got sticky dust on the reflectors; then it killed the prisms right away. It was very true about the effect of a film of dust on a globe. It was possible through this means to lose 30 per cent. If people understood the relation of light to the painting of rooms it would aid them greatly. They had a table giving the increases with certain kinds of paint. It was interesting to see the increases due to white surroundings. The matter of contrast was extremely important; it had not been realized. A very good illumination could be spoiled by having excessive contrast. If one had a certain maximum, then one must have a certain rate between that and the minimum. Contrast increased the liability to accident.

NEW SOUTH WALES AND QUEENSLAND GAS INSTITUTE.

First Annual Meeting.

In the rooms of the Royal Society, Sydney (N.S.W.), on Tuesday, Oct. 26, there was held the first annual general meeting of the New South Wales and Queensland Gas Institute, under the presidency of Mr. T. O. Morland, the Manager of the North Shore (Sydney) Gas Company.

The first annual report of the Council (which was signed by the President and Mr. H. Tindale, the Hon. Secretary) stated that the number of members on the roll was 46. Mr. R. J. Lukey, the Secretary of the Australian Gaslight Company, Sydney, was elected President for the ensuing year, and Mr. Andrew Wilson Vice-President.

After the delegates had been cordially welcomed to the city by the Lord Mayor, Mr. Bragg (the President of the Engineering Institute of New South Wales) said that old-established Society welcomed the new body into the circle of kindred associations. It was proposed to establish a library of engineering works in the Royal Society's house. The Gas Institute and all similar associations would be invited to contribute towards this library.

In the course of his Presidential Address, Mr. Morland said that during the last six months gas companies had been considerably harassed by constant labour troubles. Managers should take upon themselves the duty of making provisions which would mitigate the inconvenience of labour disturbances. He discussed at considerable length a large variety of labour-saving devices and methods for the production of gas, and remarked that recurring troubles in the coal industry could be largely mitigated by keeping surplus stocks of coal at the works. His experience at North Shore had led him to believe that coal could be stacked in the open air without any appreciable reduction of its gas-producing capacity. The gas industry was not decadent. In New South Wales, between 1907 and 1914, the number of gas-works had increased from 35 to 45. Of the latter number, 23 were owned by companies, 21 by municipalities, and one by the Government. The output of gas had increased during the same period from 2,777,936,000 to 4,674,850,000 cubic feet, and the number of consumers from 100,542 to 152,872. In Queensland, in the same period, the number of gas companies had only increased by one; but the output of gas had increased from 372,058,000 cubic feet to 745,535,000 cubic feet, and the number of consumers from 13,427 to 27,564. The cost of the production and distribution of gas in the same time had increased by 50 per cent. As to competition with electricity, his Company were soon to be faced with this problem in the four municipalities on the north side of the harbour. He did not, however, anticipate that this competition would materially decrease the volume of his Company's business. They had taken steps to combat it. Electricity had its disadvantages. It had been shown that as an illuminant it cost twice as much as gas, while as a heater it cost over three times as much. The industrial laws pressed very heavily upon most employers of labour. On gas-works they pressed more heavily than upon most. Gas-works could not close-down their businesses at a time of industrial disturbance without inflicting great inconvenience upon the general public. Industrial agreements might be entered into, and wages boards might determine by awards the amount of wages to be paid; but neither of these appeared to be sufficient. As soon as ever the workmen thought they should get more wages they made a demand; and if this was not granted, there came a threat at once to down-tools. The position had become so acute that, in a works employing (say) 1000 men, there was almost enough work now to keep one officer fully going in attending wages boards and conferences with union secretaries. Surely Parliament could impose conditions which would ensure the protection which the public so much needed. This consideration must force itself upon the attention of their legislators in the very near future.

After luncheon, three papers were read and discussed—"High-Pressure Gas Distribution," by Mr. T. F. Waugh; "Experiences in Country Gas-Works in Queensland," by Mr. D. A. Campbell; and "Experiences in the Working of Vertical Retorts," by Mr. J. Mackenzie. There was also a "Question Box" discussion on the programme.

On the following day, a much enjoyed visit was paid to the works of the Australian Gaslight Company, the North Shore Gas Company, and the Manly Gas Company.

MUNICIPAL WORKS IN REINFORCED CONCRETE.

There has already appeared in the "Journal" an extract, dealing with county councils as water authorities, from the Presidential Address of Mr. Henry C. Adams to the Institution of Municipal Engineers; and this may now be supplemented by another portion of the address, in which Mr. Adams referred to the use of reinforced concrete in municipal work.

With the exception of small highway bridges, comparatively little progress has been made in the application of reinforced concrete to municipal works. One factor is, no doubt, that much of the work to which it might be applied is small in character and in positions difficult of access or remote from centres of population. To ensure satisfactory results, it is essential that the whole of the work should be constructed by skilled labour under the direction of men with an extensive experience in such work. As these are not generally available in every district, the cost of the work would necessarily be high. Another, and perhaps the chief, reason is the extremely short period which the Local Government Board will allow for the repayment of loans for work done in this material. It would appear that in this respect the Board have departed from their now usual practice of fixing the loan period co-determinate with the probable useful life of the projected work or the average life of work of a similar character. It is well known that the actual life from numerous practical examples has already greatly exceeded the loan periods allowed; and it is surmised upon good and substantial evidence that its life is unlimited. Consider the two materials—concrete and steel. The concrete grows stronger the older it gets; and the steel, when properly embedded, is imperishable. When a structure is once loaded to its full extent without failure, little fear need be felt as to its future, provided, of course, that the steel is not stressed beyond the elastic limit. If this is done, it will stretch, and the concrete on the tension side will crack, and that on the compression side may spall, with the result that moisture will penetrate to the steel, causing rust and eventually leading to failure. The workmanship is most important; and the concrete must be dense in order that it may satisfactorily protect the steel.

Reinforced concrete, in common with some other branches of structural engineering, is to a great extent in the hands of individuals and firms interested in a particular form of construction, or, to adopt their own title, "specialist firms." In small steelwork structures—such as simple roof trusses, portable iron buildings, &c.—it is common for the manufacturers to design the work and afterwards supply the materials or the completed structure. In reinforced concrete, it is more usual for a "specialist firm" to design the work, which is subsequently carried out by a "licensed" contractor. The design of reinforced concrete is based on well-known fundamental principles of mechanics, although practical experience shows that it is desirable to make certain allowances which are not necessary under other circumstances. No doubt in the future every civil engineer will acquire knowledge in this branch as a matter of course, in the same way that he now studies brickwork. But at present such knowledge is not general; and, apart from the "specialist firms," there are only a limited number of independent engineers who are qualified and competent to design such work, or to verify the calculations relating thereto. The latter men are, however, now sufficiently numerous to cope with the amount of work to be done, only their natural modesty—to say nothing of professional etiquette—prevents their existence being so well advertised as that of the "specialist firms." The result is that the bulk of the work is in the hands of such firms; and the usual practice is for general designs or sketch plans to be sent to half-dozen of them, who each spend valuable time and money in preparing detail designs and tenders for the work.

The work of some of these firms may be above criticism; but there are others who betray lamentable ignorance or carelessness. All schemes, however, with a view to cheapening the cost, are naturally based on the minimum requirements; and the margin for contingencies in workmanship and materials is of necessity small. It must not be supposed that the client reaps the whole of this advantage of competition, because the cost of preparing the design, and not only the accepted design, but many others for other clients which have not been accepted, must be charged in the tender. I am informed that in a case recently heard in the Courts it was given in evidence that it was the custom of the "specialist firm" concerned to charge 10 per cent. upon the cost so as to cover designing charges. It would be advantageous if these and similar items were set out separately in tenders, as it would be efficacious in demonstrating to the public who employ engineers in a professional capacity that the money paid direct to them by way of salary or fees is far from being unreasonable having regard to the services rendered.

After designs have been obtained in the way described, and one has been selected for construction, the Local Government Board sometimes require that it shall be subjected to an independent opinion before a loan will be sanctioned; and this, of course, means further expense in fees. There is no reason at all why reinforced concrete work should be treated differently from (say) sewage-works or water-works. It might well be argued that it is like buying a single article. But, even so, the interests of the client demand the preparation of a detailed specification, and subsequently the exercise of sufficient skill and experience to see that the conditions of the specification are fulfilled in the design and in the construction.

The reinforcement of concrete for road beds by means of a network of strong steel wire presents several points of interest. Some of the members may have noticed from the technical papers that a High Court action was recently brought by the Gas Light and Coke Company to restrain the Woodford and Wanstead Urban District Councils from using wire-fabric road reinforcement, on the ground that its employment would be a hindrance to the Company in getting down to their mains. Experimental lengths were constructed by the Gas Company of reinforced concrete 6 inches thick and ordinary concrete 12 inches thick, upon which, at a later date, workmen were put to open through. It was found that the reinforced concrete was cut through in a shorter time than the thick bed of ordinary concrete; and the Gas Company thereupon withdrew the action.[*]

NATURAL GAS FOR WELDING AND CUTTING.

According to an author (Mr. J. F. Springer) writing in the American "Railway Age Gazette" for October, while ordinary natural gas consists largely of methane, the heating value of which is low in comparison with acetylene, there is at Follansbee, West Virginia, a natural gas produced which contains no methane and is made up of approximately four-fifths propane and one-fifth ethane—a gas with a thermal value of 2468 B.Th.U. per cubic foot. Experiments with the gas at various stages of compression indicate that the constituents of higher thermal value are first liquefied, leaving the others in the residual gas. When subjected to 400 lbs. pressure per square inch at 32° Fahr., and revaporized, a gas of varying quality was obtained. Of several samples taken at regular intervals, one was almost pure ethane, another almost pure propane. The lowest thermal value was 1808 B.Th.U., and the highest 2621 B.Th.U. per cubic foot. The methane which has the lowest heating value (1065 B.Th.U.), and so is the least desirable in the semi-liquid product, needs a pressure of 2700 lbs. per square inch to cause it to liquefy, and is therefore not apt to be present in the products of compression under 400 lbs. per square inch.

From another set of experiments with Follansbee gas under 400 lbs. pressure, it was found that samples drawn from the top of the same cylinder varied considerably in quality and heating value. It was found, however, that by drawing the supply for the torch from the bottom, a gas of approximately uniform quality may be obtained. Its boiling-point is –40° Fahr.; and at 32° Fahr. it requires a pressure of 400 lbs. to maintain it in a liquid state. At 131° the pressure is 755 lbs., which is well within the practice of handling similar products. If higher temperatures are apt to be met, it will not be difficult to secure containers to withstand the higher pressure.

The new gas seems to have originated through the development of natural gas gasoline, which was first obtained by simply collecting the liquid formed by condensation in pipes transmitting natural gas. The next step was artificial chilling of the pipes, followed by low-pressure, single-stage compression, and later of carrying the raw gas through two stages of compression.

INDUSTRIAL USES OF TAR OILS.

The enhanced importance for industrial purposes which the constituents of tar oils have attained in the course of the present war has prompted our contemporary, the "Journal des Usines à Gaz," to publish a series of articles by Professor Mailhe, of Toulouse, in which are passed under review the bodies occurring in tar oils —particularly in respect to their use in the manufacture of explosives and drugs, and with regard to the methods that gas makers should follow for their recovery. The full text of these papers would not repay translation, since much of the matter is familiar to those in this country who have made a study of residuals; but an abstract of portions of M. Mailhe's contribution may be made —particularly of those which deal with the properties of certain aromatic hydrocarbons in tar, the industrial value of which has not hitherto been sufficiently realized.

In the light oils distilling from tar at temperatures from 175° to 280° Fahr., the most important hydrocarbon next to benzene is toluene, present in quantity about one-third that of benzene. An average yield of toluene is 1 litre per tonne of coal. Xylenes and ethyl-benzene and the paraffin hydrocarbons of the cymene groups likewise come over at these temperatures, but in far smaller quantities—benzene and toluene being the two raw materials from tar for the making of explosives, dyes, and other chemical preparations. While benzene is of secondary importance as a material for explosives, by conversion into picric acid [melinite], toluene in its tri-nitrated form of "T.N.T." or "Tolite" is sought after for its many valuable properties in artillery.

M. Mailhe places the French pre-war production of crude "benzol" (benzene, toluene, &c.) from all sources at 5200 tonnes, which includes that obtained by coke-ovens. He dismisses the synthetic conversion of benzene into toluene as being commercially impracticable. Efforts to increase production may be made in the direction of the removal of toluene from (1) coal gas, and (2) light petroleum oil. The former source—though attractive at first sight—is one which will be drawn upon with much caution, owing to the large plant required for washing gas with the extractive tar and for the subsequent distillation of the hydrocarbons from it.

In the case of petroleum oil, only that is of value which yields distillates containing aromatic hydrocarbons. Borneo oil is an important source, which Germany has long utilized for the production of benzene, toluene, xylenes, &c. One works at Rotterdam treats several tonnes per day of Borneo distillate containing from 15 to 20 per cent. of aromatic hydrocarbons and representing not 1 per cent. of the crude oil. Benzene, toluene, xylenes, and cumenes are obtained by repeated rectification; but the laborious process is not successful in yielding pure products—the toluene always containing some 30 to 40 per cent. of paraffin hydrocarbons, though still utilizable for the manufacture of explosives by first converting into the mono-nitro compound, distilling off the fatty hydrocarbons in steam, and then carrying the nitration to the di- and tri- stage.

As regards substances of the phenol and cresol groups present in tar to the extent of 12 to 15 per cent., only the tri-nitro derivations are of importance as explosives; tri-nitro phenol [picric acid] being the explosive body most largely used, and normally produced from phenol recovered from tar. The French authothorities have, however, been successful in organizing the manufacture of picric acid from benzol by synthetic processes.

The use of the cresols presents difficulties as regards the formation of tri-nitro compounds in the case of para- and ortho- cresol, though the explosive, "Ecrasite," which is used in Austria, is of this origin.

Naphthalene, forming 50 to 60 per cent., of the medium tar oils, is readily nitrated—forming explosives which require admixture with an oxidizing salt for their full effect. Dinitro naphthalene and ammonium or sodium nitrate is the admixture most usually employed. It forms the basis of the Favier series of explosive powders—possessing many notable advantages, and more recently used by Schneider's firm for filling shells. Naphthalene is, in fact, a plentiful and valuable raw material; and M. Mailhe lays special emphasis on the importance to gas makers of methods for the recovery in future of both naphthalene and phenol as saleable products.

In his reference to pharmaceutical compounds derived from tar, M. Mailhe does little more than quote a recent report by M. Ernest Fourneau, the Director of the Laboratory of Therapeutic Chemistry, to the "Société d'Encouragement pour l'Industrie Nationale," in which he takes his countrymen to task for their timidity in allowing Germany to gain possession of the manufacture of organic medicinal substances, while at the start they [the French] had the advantage of their supremacy in the supply of medicaments of inorganic origin. He reproduces a schematic synopsis from M. Fourneau's paper showing the numerous Teutonic products prepared from the raw materials in gas tar.

Marriage of Mr. Bloor.

On Saturday, at St. Philip and St. James' Church, Clifton, York, by Rev. C. T. Alexander, M.A., Harold Edgar, eldest son of Mr. Henry Bloor, J.P., of Garswood, Hoylake, was married to Alice Maud, only daughter of Mr. William Bellerby, of Clifton, York. The bridegroom is the Secretary and Manager of the York Gas Company.

Gas-Works Directory and Statistics for 1915-16.

Once more the work has been undertaken by Messrs. Hazell, Watson, and Viney, Limited, No. 52, Long Acre, W.C., of bringing up to date—or as nearly so as is possible, for even while the book is in the press further official and other changes are, of course, taking place—their well-known "Gas-Works Directory and Statistics." The issue for 1915-16—the thirty-eighth of the series—is now ready; and the statistics contained in it have been revised to August last. The book has been prepared on the same lines as hitherto; and those who consult it will accept the assurance given by the Editor that every effort has been made to obtain the latest available information—the source being the managers, engineers, and secretaries of the various gas undertakings. These are times of changes in gas prices; and it is pointed out that in cases where rates of charge have been altered since the date of the receipt of official figures, a separate line has been inserted, with the amount of the increase. In addition to the full information given with regard to the different undertakings, there is an alphabetical index of gas-works officials, and a list of Senior and Junior Associations of Gas Engineers and Managers throughout the country, with the names in each case of the President and Secretary. The price of the directory, it may be mentioned, is 10s. 6d. net.

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[*] See "Journal," Vol. CXXX., p. 764.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Who was the Originator of the Sliding-Scale?

Sir,—Let me see if I can trace the source of the sliding-scale to a more remote date than any yet reached by your correspondents?

Many years ago the late Mr. B. Leigh Smith (a Director of the Gas Light and Coke Company) gave me a copy of a paper he had written, and had had printed and circulated, in which he made the following suggestions:

1. That gas can be supplied more cheaply by a company having a district to itself than when it has to divide the lighting, and consequently the profits, with another company.
2. That a company would supply gas as cheaply as possible if it were its interest to do so.
3. That it would be the interest of a company to supply gas as cheaply as possible if, by Act of Parliament, the dividend were made to vary with the price of gas, so that the lower the price charged for gas the higher should be the dividend allowed to be paid.

Mr. Leigh Smith informed me that he wrote this paper "about the year 1860;" and, seeing that the London gas companies were actually districted by the Metropolis Gas Act, 1860, his first suggestion affords internal evidence that it was written not later than the parliamentary session of that year.

H. D. Ellis.

Dec. 10, 1915.

Pooling of Coal Waggons.

Sir,—I desire to draw attention to an important proposal by the Board of Trade, to pool all railway-owned and private owners' coal waggons, as I am of opinion, if the latter project be carried out, it will prove prejudicial to many large users obtaining adequate supplies of coal, which in certain industries is of primary importance.

To the pooling by railway companies of their own waggons, traders can raise no objection; but it is very doubtful whether the pooling of private-owned waggons would, in actual practice, realize the benefits it may seem to offer in theory. And there are many objections to this waggon-pooling project, irrespective of their ownership.

The effect of this would be that those who have exercised sufficient forethought, and incurred the expense of providing their own waggons, would lose control of them. It means that they would be unable to allocate sufficient waggons to any particular contract, with the almost certain result in many instances of a shortage in deliveries. It is the common experience in times of difficulty and stress, that those who have not their own waggons find much greater difficulties in obtaining regular supplies than those who are in a position to ear-mark waggons specially labelled to run to and from particular points, and to which they must be delivered and nowhere else.

The provision of their own waggons for "Class A" traffic by many gas undertakings, colliery proprietors, coal factors, and other large coal-users has to a large extent saved the situation. But now it would appear that they are to be penalized because there is a shortage of railway-owned waggons for mineral traffic.

The relative tonnage carried by private owners' waggons is greater than by railway-owned waggons, because in the former case they are under more strict supervision than is possible by the railway companies—no doubt in some respects, owing to the fact that what is common to all is nobody's particular business. It is well known how waggons are often unreasonably delayed, in consequence of inattention on the part of those responsible, congestion of traffic, and using them for storage purposes.

I hope the gas industry will enter an emphatic protest against this proposal, which instead of facilitating deliveries of coal, is much more likely to very seriously jeopardize supplies all round, and lead to further chaos. Any interferences with coal supplies to so important a national industry as the supply of town's gas, would be a serious matter to the country at large—especially at the present time.

I suggest that all gas undertakings interested should immediately write a letter of protest to the Secretary, Railway Department, Board of Trade, Whitehall, S.W.

J. Ferguson Bell.

Derby, Dec. 11, 1915.

Tar for Retort-Setting Heating.

Sir,—With the present low value of tar and pitch, and the comparatively high prices now ruling for coke, it has occurred to me that gas-retorts can with advantage be heated by means of dehydrated tar or pitch.

This applies more particularly to gas-works which have a tar dehydrating plant installed. If the tar is treated to dispel the light oils in conformity with the War Office regulations, I think there is a very good case for heating the retorts economically, and allow a considerable quantity of coke to be placed on the market.

If any of your readers have experience in burning solid or semi-solid pitch, it would be interesting to hear their views.

Alpha.

Dec. 6, 1915.

Circulars of Inquiry.

Sir,—In the spring of this year I called your attention to a very bad case of the inquiry circular nuisance in connection with a northern gas-works, with reference to street lighting. An even worse case is that which recently came to hand from the Margate Borough Surveyor, and from what I have heard these inquiry forms have been sent broadcast throughout the country.

In these strenuous times, with the shortage of assistance prevailing, the waste-paper basket is the most suitable receptacle for documents of this description; but as the writer from Margate went beyond the limits of an ordinary inquiry, and asked for professional advice free, and other information of an entirely technical nature, I thought fit to reply to his questions in such a way as to compel him to realize that the brains of the gas industry cannot be sucked free of charge.

It may also be recalled that in May, 1907, inquiries were sent broadcast from the same individual with a view to acquiring information on the art of sulphate maanufacture, about which some caustic remarks were made at the time.

I think it would be as well if the gas industry left any inquiries from Margate strictly alone, as the Corporation do not own the gas-works there. The information is no doubt called for with a view to harrowing the Isle of Thanet Gas Company; and at the present time one can hardly care to assist in doing that.

Northern Gas.

Dec. 7, 1915.

Naphthalene Troubles.

Sir,—As many gas undertakings are suffering from an abnormal number of naphthalene stoppages, consequent upon the extraction of toluol and benzol vapours from the gas, and as in some cases advantage is being taken of this by our competitors, who do not explain the cause to the consumer, it has been thought that it might be useful to managers to have an official explanation of the circumstances to send to any consumer who has suffered serious or repeated inconvenience from this cause.

I enclose a copy of the circular that has been prepared, and should be pleased to supply any number required at 6s. per 1000.

W. M. Mason, Secretary,
British Commercial Gas Association.

47, *Victoria St., S.W., Dec.* 13, 1915.

P.S.—It had been suggested that information on the lines of the circular should be issued to the public Press; but after most careful consideration, the Committee agreed that the best interests of the industry would be served by the matter being dealt with locally, instead of nationally.

[Enclosure.]

The Gas Industry and the War.

Temporary Inconvenience to Consumers caused by the Extraction of Raw Material for High Explosives from Gas.

The attention of gas consumers is directed to the following facts:

1. The country is dependent for the high explosives required in ever-increasing quantities by the armies and navies of the Allies upon the supply of toluol and benzol.

2. The main sources of supply of toluol and benzol are the gas-works, and the quantity of these materials that can be supplied to the Government depends strictly upon the quantity of gas supplied to the public.

3. The extraction of these vapours from the gas, by a costly and unremunerative process, while it does not appreciably affect the value of the gas to the consumer, does affect its capacity for retaining certain constituents (such as naphthalene) in gaseous form. These constituents are consequently more liable to solidify and deposit in the pipes carrying gas to the consumer. This is causing some inconvenience to the public, as well as hindering and making more costly the normal work of gas undertakings.

4. Steps are being taken as rapidly as possible with a view to counteracting this trouble, by special means that will not interfere with the supply of toluol and benzol to the Government.

5. Those of the public who may suffer temporary inconvenience from this cause are therefore asked to remember that the trouble is occasioned by the imperative necessity of providing the Government with the raw material for high explosives, that it is quite of a temporary nature, and that the continued and increased use of gas is at the present time of vital importance to the nation, and has a direct bearing upon the speedy armament and early victory of our forces.

W. M. Mason, Secretary,
British Commercial Gas Association.

N.B.—Should any consumer experience any shortage of gas supply, he is requested to communicate immediately with the gas-works or office, so that the trouble may be speedily rectified.

Loughborough Gas-Works Profits.—It was remarked by Mr. Toone, at a meeting of the Loughborough Town Council last week, that the Gas Committee's balance-sheet for the past half year showed an excellent six months' trading. The profit made was £2855, against £2066 in the corresponding half year. The result reflected credit on the works; and though they could not say they were out of the wood yet, and could not anticipate the future at such a time, yet they had done very well. It might be of interest to state that the ordinary consumers had maintained their numbers—2140, against 2139; while the slot consumers had gone up from 3430 to 3570, and cookers from 733 to 757. The gas consumed showed a small increase of 138,000 cubic feet, or 0·24 per cent.

Government Claims a Council's Water-Pipes.—At a recent meeting of the Nantwich District Council (according to the "Ironmonger"), discussion took place over correspondence with the contractors for the supply of pipes for the Audlem Water-Works, whose account to date was £6268. The Local Government Board had asked for particulars of the contract, and had suggested taking over the pipes for Government purposes. The contractors had referred them to the Council, as the pipes could not be replaced on such favourable terms. The Clerk pointed out that the Government would not lend money to the Council. It might be years before they would be in a position to go on with the work; and if they took up money, it would mean that they would have to pay heavy interest charges. He thought their reply should be that they were content that the pipes should go, if the Government would release them from any obligation. It was decided that the suggestion made should be put before the Local Government Board.

REGISTER OF PATENTS.

ias-Lamp Automatic Connecting, Suspending, and Lowering Device.

Stevenson, J., and Williams, O. R., of Darlington.

No. 21,706; Oct. 29, 1914.

This invention is to enable a lamp to be suspended on a span wire t a convenient position over a street and at the same time to allow of t being automatically mechanically suspended on the span rope and utomatically connected through to the gas supply, conveyed to a fixed onvenient position on the span wire, for lighting the thoroughfare. he arrangement is such that the supply can be automatically conected to, or disconnected from, the source of supply on the span wire, nd the fitting slightly lowered and taken to the side, mechanically uspended, released, and lowered at any convenient position at the entre or side of the street, and again raised on to suspension and taken ut on its trolley support, suspended, to the source of its supply and utomatically again connected from the source of supply to the lamp. ll operations are carried out by a specially designed combined twin vinch which allows of a free feed of the wire from one drum, and a elf-sustaining winch for raising, lowering, and side-traversing, and *ice versa*, both working in conjunction to effect the necessary movenents—the winch being so designed that, should the fitting not be roperly suspended, the drum is locked and cannot be released until it s securely suspended. The locking and unlocking are effected by the veight of the lamp tension on the rope and the sag of the rope when reed from the weight.

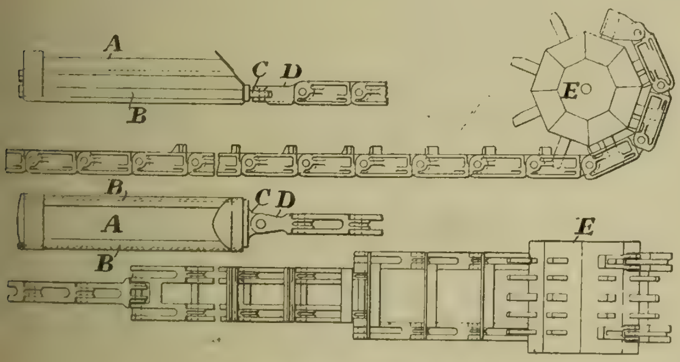
The means for carrying out the invention are described in a lengthy pecification of more than seven printed pages, with a page of "claims" nd three sheets of detail drawings.

Charging and Discharging Retort Machines.

Aldridge, J. G. W., of Victoria Street, S.W.

No. 22,066; Nov. 5, 1914.

This invention relates to multiple-stroke charging machines for gas-retorts (applicable for discharging "through" retorts), comprising a charging receptacle or scoop with a hinged push-plate at the forward end for pushing-out the coke and a chain or jointed push-bar or ram connected with the rear end for moving the scoop into and out of the retort. The scoop is constructed like the charging member in the Fiddes-Aldridge machine—of suitably connected and spaced side-plates with a swinging push-plate in front; the scoop being bottomless and moved into the retort over an apron plate which forms a bottom for the scoop outside the retort.



A side view and plan are given of a charging chain and scoop constructed according to the invention; also a front and side elevation of the wheeled supporting framing of the machine.

The bottomless scoop A, consisting of two side plates B connected at the forward end by an arched stay and carrying in front a hinged push-plate, is closed at the rear end, and to it is attached a connecting member C, which is in turn jointed to the front link D of a butt-jointed chain. The chain is made in three sections of different widths—the length of each section corresponding with one convolution when the chain is wound on the polygonal drum E. The rear section of it is formed of parallel slotted side links pivotally connected by pins at the joints, and spaced apart by cross stays so disposed as to leave a free space between the side links for the accommodation of the links of the contiguous section when the chain is wound up. The drum, through which the chain and attached scoop are actuated, is built-up of cast-iron segments with radial teeth fixed in it, and arranged to engage the slots in the links of the chain. An apron plate F, on which the scoop rests when being filled with coal, is mounted on wheels which run in guides in a guide-frame in the machine. The apron plate is advanced towards the retort or withdrawn by (say) weights and gear, or the scoop itself may engage and actuate the apron plate as it is driven into, or withdrawn from, the retort.

For filling the scoop with coal, a telescopic shoot G, depending from the hopper H, is provided at its lower end with doors mounted to slide horizontally in guides and having pin and slot connections with pivoted arms or levers, which are, in turn, connected by links with levers carried on a rocking shaft, on which depending or striking arms are fixed to project into the path of stops on the sides of the charging scoop.

The winding drum E, motor L, chain and scoop A, apron plate F, shoot G, and feed hopper H, are compactly mounted in a wheeled frame M, provided with a controlling platform N, and adapted to be traversed along the retort-house in front of the retorts in the usual manner—the shoot and charging members being vertically adjustable in the frame to suit the different heights of retorts.

In the operation of charging a retort, the scoop having been drawn back and filled with coal, the chain and scoop are first advanced—the projections on the scoop engaging spring or other catches on the apron plate to cause the plate to move outwards with the scoop. This movement of the scoop and apron plate continues until the apron plate is stopped against the retort mouthpiece when its catches are forced open (or the weights and gear brought to a standstill) by the further advance of the scoop, which continues its forward movement, pushing the charge of coal off the apron plate and along the retort-bed.

During the advance of the scoop from the filling position towards the mouth of the retort, the depending or striking levers on the feed shoot G are operated by projections on the scoop to close the doors of the shoot. Likewise, on the return stroke of the scoop after depositing the charge of coal in the retort, the apron plate is drawn back by stops, and the levers actuating the doors of the shoot are swung back on the scoop to open the doors and allow the scoop to be refilled with coal from the hopper on the machine.

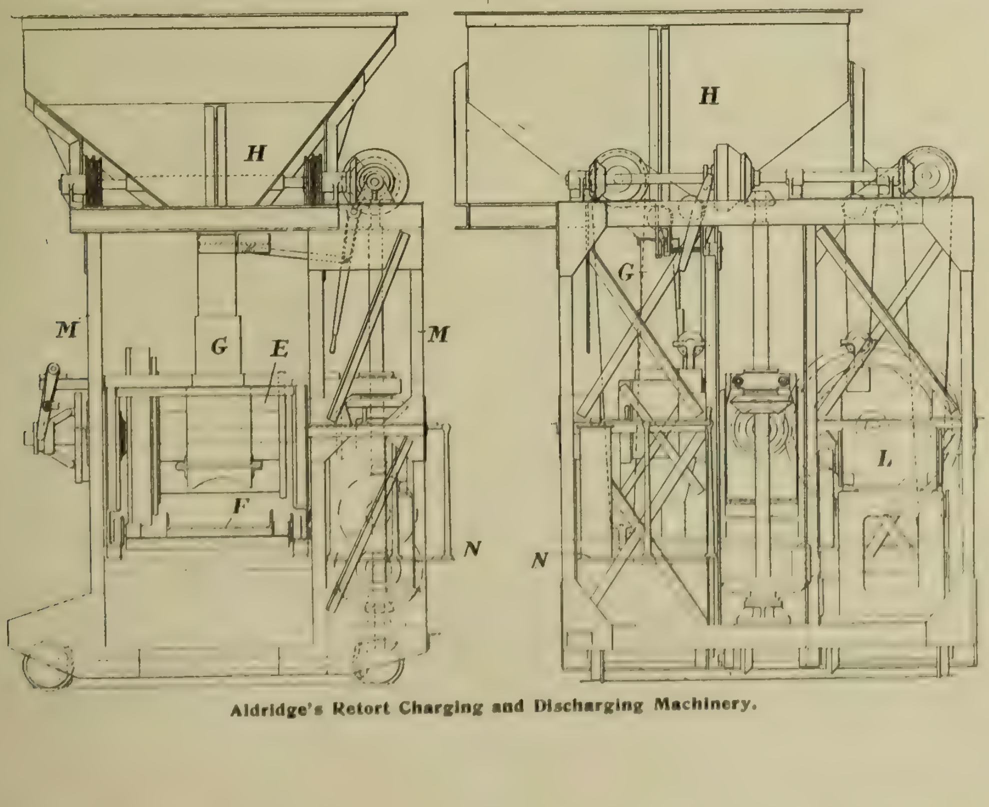
Clockwork Apparatus for Lighting and Extinguishing Gas-Burners.

Canova, V., of Birmingham.

No. 22,021; Nov. 4, 1914. No. 1416; Jan. 28, 1915.

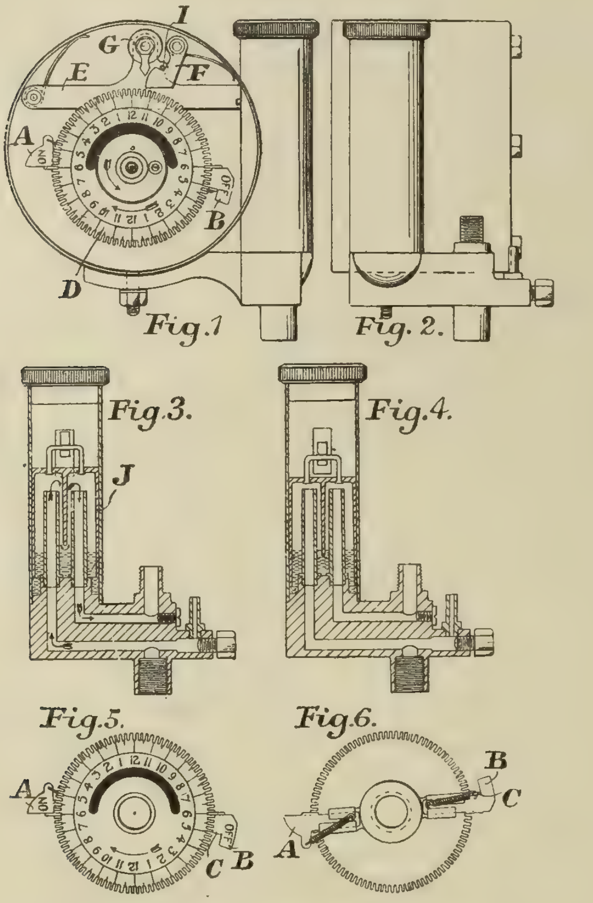
This combined invention relates to clockwork controlled valve apparatus for lighting and extinguishing gas-burners, in which a spring-urged lever connected to the valve moves into one operative or raised position by one of a pair of cams engaging a roller on the lever—the cams being carried adjustably upon a dial divided into day and night portions, and held in such raised position by means of a spring-urged latch until, by the action of the second cam on the latch, the lever is allowed to fall to its other operative or depressed position.

The principal feature of the apparatus shown consists in a clock-



Aldridge's Retort Charging and Discharging Machinery.

work controlled valve in combination with a spring trip lever having on its upper side an arm carrying a friction roller in the path of cams adjustably mounted upon a dial provided with a notched edge—the trip lever having direct connection with the valve.



Canova's Gas-Burner Lighter and Extinguisher.

Fig. 1 is an elevation of the device with the cover removed so as to show the general arrangement of the working parts. Fig. 2 is a side elevation of the gas outlet and inlet valves in their relative positions. Figs. 3 and 4 show in section the gas-valve in the open and closed positions. Figs. 5 and 6 show a front and back view of the dial with the cam projections attached to it.

The operation of the invention is as follows: The hour for lighting is set by means of the cam A, which is moved over the dial face D to the desired time indication. The other cam B has an extension C to contact with the pawl F, and is also set to extinguish at the desired hour. The dial D now rotates under clock control. As the lighting or "on" cam rotates with the hour disc, it engages the roller G mounted on the lever E, lifting the same. At its point of greatest lift (or immediately prior thereto), it is arranged that the pawl F is engaged by means of its hooked part to the pin I on the lever E, thus holding it up. This lifts the cap of the gas-valve J admitting the supply of gas to the burner, where it is ignited from the bye-pass in the usual manner.

Further rotations of the dial D brings the "off" or extinguishing cam B into operation. It lifts the roller G sufficient to free the pin I from engagement with the pawl F. The projection C, on the under side of the cam B, now engages the pawl and presses it out of contact with the pin I; this action being continued after the cam has left the face of the roller G, so that the lever E is free to drop into its lowest position and thereby act upon the gas-valve J and extinguish the light. After the pin on the under side of the cam B has passed the pawl, the latter, under the influence of a spring K, returns to its inoperative position, which is relatively fixed by the stop-pin I. In order that the setting cams can be easily manipulated by inexperienced persons, they have a protruding finger-piece which allows of their being easily grasped, raised, and set; a pointer dependent from the roller shaft on the valve lever F indicating, by means of a vernier cut on the cam, the exact point at which the valve operates to light or extinguish. Thus the whole of the operative parts of the device are immediately available directly the cover which entirely encloses the apparatus is removed—the winding shaft of the clock mechanism being central with the hour dial.

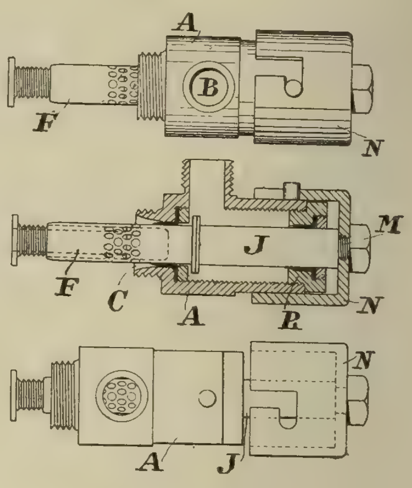
Cocks or Valves.

Turner, William, of Sheffield.

No. 22,096; Nov. 6, 1914.

These cocks or valves have a barrel with inlet and outlet openings provided with a perforated tube enclosed at one end and disposed in one of the openings in such a manner that it is capable of being moved longitudinally so as to increase or decrease the amount of gas or the like passing through the perforations. The perforated tube is preferably secured at one end to a cap fitting over the barrel, and locked to it by a bayonet joint. The open end of the hollow tube is provided with an adjustable internal sleeve to reduce or increase the operative number of perforations in the tube as desired.

The cock referred to is particularly adapted for use in clearing service pipes by compressed air, gas, or the like—the inlet of the cock being connected to a reservoir containing the compressed air or gas and a flexible tube connecting its outlet to the pipe to be cleared. The connections being made, when the cap is released the contents of the reservoir will instantly force open the valve and pass through the outlet at the maximum velocity into the pipe to be cleared. If used at low pressure, a coiled spring would be placed inside the barrel to assist the inward movement of the plunger.



Turner's Service Clearing Cock or Valve.

The illustration shows a side view of a cock or valve closed, a section, and a side view of a valve open to its full extent. The barrel A is provided with orifices B and C, which perform the function of inlet or outlet according to the direction in which the gas flows through. Centrally within the chamber is a valve, which consists at one end of a perforated tube F closed at its upper end. The other end is formed of a parallel spindle J provided with a fixed collar and a loose shock-absorbing collar of fibre, so as to limit the opening movement of the valve. The end of the spindle remote from the tube terminates in a reduced threaded portion M, which carries a cap N which fits easily over the outside of the barrel, and is secured in position on the barrel by a bayonet joint. The spindle is kept parallel within the barrel by a collar of approximately the same diameter as the exterior of the chamber, but which has a reduced threaded portion R which is screwed into the interior of the barrel and holds the collar in position. The collar has a central bore within which is located a packing secured in position by a threaded nut screwed into a recess in the collar.

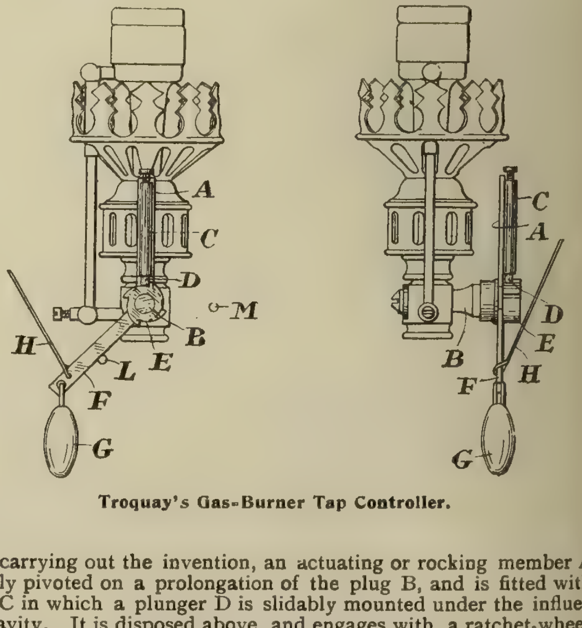
When the cap N is locked by the bayonet joint no air or fluid can pass through the barrel A, as the perforations are outside the packing E; but if the cap is released, the spindle J and tube F will be forced by the pressure behind it, thus bringing the perforations within the chamber A, and consequently any air or gas passing up the tube will pass through the perforations into the barrel and thence out by the orifice B.

Controlling Gas Valves and Cocks.

Troquay, J., of Kentish Town, N.W.

No. 9296; June 24, 1915.

This invention is shown in connection with a bye-pass gas-burner—a front and side elevation.



Troquay's Gas-Burner Tap Controller.

In carrying out the invention, an actuating or rocking member A is loosely pivoted on a prolongation of the plug B, and is fitted with a tube C in which a plunger D is slidably mounted under the influence of gravity. It is disposed above, and engages with, a ratchet-wheel E secured on the prolongation of the plug. An arm F of the member A is counterweighted by a hanging weight G, and has one end of some flexible member H secured to it. The pulling of H causes the member o rotate the valve or plug B through a quarter of a revolution, by dium of its plunger D engaging one of the teeth of the wheel E. In s way the valve is opened or closed and the gas turned on or off cording to the position of the valve before the apparatus was operated. hen H is released by the operator, the actuating member A returns medium of its counterweight to its normal position, without rotating valve or plug. Stops L M limit the movements of A; while the ight of the plunger D maintains it in engagement with the wheel E ring the operating and return movements of A.

APPLICATIONS FOR LETTERS PATENT.

6,831.—Cross, F. W., "Gas-meter valves." Nov. 30.
6,891.—White, A. E., "Coal gas generating." A communication m the Riter-Conley Manufacturing Company. Dec. 1.
6,905-6.—Brown, D. A., "Gas-furnaces." Dec. 1.
6,932.—Tully, C. B., "Manufacture of hydrogen or a mixture of drogen and carbon monoxide." Dec. 1.
6,945.—Wootten, E. D., "Gas-producer." Dec. 2.
7,045.—Carroll, L. D., "Production of gas." A communication m J. M. Rusby. Dec. 3.
7,046.—Carroll, L. D., "Gas-making apparatus." A communican from O. B. Evans. Dec. 3.
7,084.—Brown, E. W., "Gas-heated radiators." Dec. 4.
7,089.—Casbon, W., and Dunkinson, A. J., "Incandescent rners." Dec. 4.

War Allowances to Employees Surcharged.—The Local Governent Board District Auditor has surcharged the Camberwell Borough uncil £900 in respect of payments to workmen and officials who are rving with the Colours. The Auditor states that in most of the cases e money paid by the Council, when added to the Government payents, doubled the sums available for the maintenance of the men's milies.

Newry Gas Undertaking.—The Irish Local Government Board ditor, in his report on the Newry gas undertaking, states that the counts show a profit of over £600 for the year, despite the increased ice of coal, and the fact that the works have to meet an annual payent of £1800 in respect of loans. The Chairman of the Gas Comittee (Mr. P. M'Caffrey), at a meeting of the Urban Council, said ey had also paid for a new gasholder. He suggested that the debt ight be cleared, if they could arrange for a grant from a local bequest nd. If this were done, it would be possible, in normal times, to pply gas at 2s. 6d. per 1000 cubic feet. The Council deferred conderation of the suggestion.

LEGAL INTELLIGENCE.

RATING OF THE CHERTSEY WATER-WORKS INTAKE.

In the House of Lords, Earl Loreburn, Lord Atkinson, Lord Shaw, and Lord Parker met last Thursday to give their considered judgment in the appeal by the Metropolitan Water Board against an order of the Court of Appeal in favour of the respondents, the Assessment Committee of the Chertsey Union.

Counsel in the case were: For the appellants, Mr. Ryde, K.C., and Mr. Jacques Abady [holding the brief of Mr. H. Fletcher Moulton, serving with H.M. Forces]; for the respondents, Mr. Page, K.C., Mr. W. Mackenzie, K.C., and Mr. Laurence Tooth [holding the brief of Mr. H. Conacher, serving with H.M. Forces].

The arguments were concluded and judgment was reserved on Nov. 1 (*ante*, p. 327).

Earl Loreburn, in giving his decision, said that the Quarter Sessions had fixed, subject to a special case stated, the assessment of a strip of land some nine acres in extent belonging to the Metropolitan Water Board, and comprising an intake from the River Thames, together with buildings and works; the abstraction of water being authorized by an Act of Parliament for the benefit of the Water Board. It was an unproductive part of a great profit-earning concern, which earned its profits in many parishes.

Both the Assessment Committee and the Water Board contended, and the Quarter Sessions held, that the proper basis of assessment was to take the cost paid for the land and for erecting the buildings and works some years ago, and then to take a percentage upon the cost in order to arrive at the annual value.

But the Assessment Committee contended that there should be added a further sum as being an enhanced value in respect of the user made of the intake, and the statutory right of appropriating water withdrawn from the River Thames by means of it, and the proximity of the river for the taking of water into the Water Board's pumping tanks; and therefore the piece of land in question had an added value by reason of its special fitness for this purpose. The Committee contended that the aggregate of such percentage and enhanced value was the rent at which the premises might reasonably be expected to let from year to year; and they relied on the case of the *New River Company v. Hertford Union*.

On the other hand, the Water Board contended that no such addition should be made, because all the elements of the supposed enhanced value that were relevant had been already covered by the price or cost. They further contended that, as they themselves were the only possible tenants of these premises and stood in very good credit (being able to borrow at 3½ per cent), the rent of the hypothetical tenant

THE MAIN GAS FIRES.

The ST. NICHOLAS.

The St. Nicholas—
The Gas Fire without a rival.

The new booklet—"Main Reflections"—contains particulars of several new Gas Fires. Copies free on application.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

should be fixed, in view of their financial credit, at 3½ per cent. on the cost of the land and the works. It was put on their behalf in this way: "If we do not get a low rent, we are in a position to borrow money at a low rate and can build other water-works for ourselves, and the interest on our outlay would be less than the rent you ask to have fixed."

Quarter Sessions rejected both the appellants' and the respondents' contentions. He would not enter upon the question whether or not their decision on such matters was final, for that was not treated as the real point in the argument. He preferred to say that he thought Quarter Sessions were perfectly right in their conclusions.

The statutory test of what a hypothetical tenant might reasonably be expected to give as rent was a rule-of-thumb, however difficult to apply, that must govern such a question. When cost was taken as a basis, it must surely be on the footing that what had in fact been paid presumably indicated capital value, and that interest on it presumably indicated annual value. When a man paid a price for the fee-simple of land, whatever fitness or capability for profitable use there existed in the land, or might run with it, was surely covered by the price he paid, unless some special arrangement was made of which there was no trace in this case. How could it be said that something should be added to the capital value or to the annual value by reason of such things as the proximity of the land to the river or its special fitness for some industrial purpose? All this had been included in the cost price. Or why should anything be added "in respect of the user made of the intake"—a phrase of which he did not grasp the meaning, beyond seeing clearly that this was not a rateable subject at all? Or how could it be said that anything should be added because the person who bought the land, or who now owned it, had a statutory right, personal to himself, of using it in a particular way and of drawing water through it from the Thames? For that did not make the land itself more valuable. It only made the owner or occupier of it more able to make profits. It might as well be said that a piece of land was more valuable because the tenant of it had a valuable patent which he worked on the land.

Coming to the claim of the Water Board, that the hypothetical rent should be "fixed" at a lower figure because they were the only possible tenants, and could borrow at less than the current rate of interest. He thought this was a singular argument, and had been properly refuted by what he had said in the Assessment Committee's case; but Mr. Page, speaking on their behalf, threw that over, and, if he understood him aright, accepted the proposition that the financial standing of the Water Board was a proper element for consideration. He thought it was certainly a wrong contention when the basis of cost was adopted. If it was permissible to regard the wealth of a possible tenant, it was permissible to regard also the wealth of the possible imaginary landlord; for the one was as relevant as the other in any conjecture as to the rent that would result from bargaining between the two.

Having dealt with other points in argument, his Lordship said he was of opinion that the appeal of the Water Board should be allowed. But as both sides had advanced untenable contentions, he moved that the order of Quarter Sessions be restored, and that there should be n costs there or below on either side.

Lord Atkinson said the point in controversy in the case was the rul or principle to be adopted in valuing for rating purposes certain indirectly productive portions of the appellants' water-works. He thought on a series of authorities he referred to, that it was perfectly legitimat to take into consideration what was the annual cost which the owner would be put to in acquiring the ownership of rateable hereditament as some guide, in the circumstances, as to what rent they would b willing to pay for them if they were not the owners. It was not at al conclusive, but merely an element to be considered. Where he disagreed with the contention of the appellants on this point was that, in ascertaining the annual cost, it was wrong to take the annual market valu of the capital sunk in the acquisition of the hereditaments—that is, th usual rate of interest, but merely the rate of interest at which the owne could procure the capital. Were this not so, a public body to whor some generous benefactor made a present of money to enable them t acquire land compulsorily for some philanthropic object, of which the owner approved, would presumably be unwilling to pay any rent fo the enjoyment and acquisition of the land, as they could acquire it i fee for, in effect, nothing. On the whole, however, he agreed in the judgment proposed.

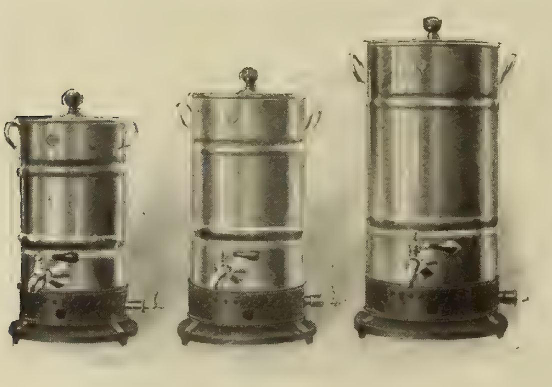
Lord Shaw also read a judgment. In dealing with the second part of the case, his Lordship pointed out that if the contention of the Water Board were upheld, it might lead to startling results. A clever financier could show the valuation authority that he could borrow money on easier terms than his neighbours; and therefore—so it would be argued—the rateable value of his land had gone down. This advantage would be countered by the disadvantage of the poorer owner of a similar plot; and the heavier the latter's burden of interest the higher would be the value of his landed property. This was unarguable; and he would only add that a further startling result would follow—that when the terms of public loans became more onerous, the rateable value of hereditaments would be increased. Such were the dangers of confusing personal advantages with those inherent to the land. He agreed with the judgment proposed.

Lord Shaw then read a judgment by Lord Parker, who agreed to the appeal being allowed.

Order accordingly, no costs to either side, there or below.

CONSTRUING A WATER SUPPLY AGREEMENT.

In the Chancery Division of the High Court of Justice last Tuesday, Mr. Justice Sargant heard an action in which the Tynemouth Corporation asked for an injunction restraining the Newbiggin-by-Sea Urban District Council from supplying water to places outside the area constituted by an agreement dated April 17, 1907, between the two



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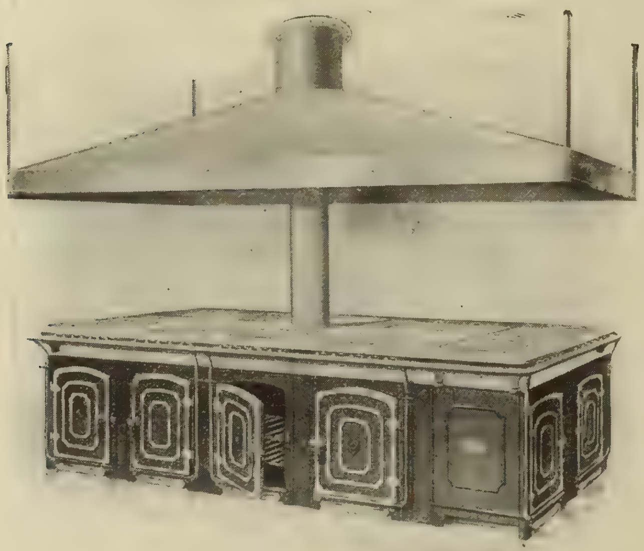

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Davis Hot Closet with Three Sliding Doors.

thorities, under which the defendants received water from the plain-
s. The plaintiffs also asked for damages for taking water in excess
the amount provided for in the agreement.
Mr. Mark Romer, K.C., and Mr. J. G. Wood were for the plaintiffs;
d Mr. E. Page, K.C., and Mr. Schofield for the defendants.
Mr. Romer, in opening the case, said that by their 1897 Act the
intiffs had the power to supply water in bulk to places outside their
ea. They made the agreement referred to with the defendants; but,
ce the date of the agreement, the defendant Council's area had been
reased. The question was whether the agreement compelled the
rporation to supply water to the added area. The defendants had
up, in their defence, a plea of estoppel by conduct; saying that
cause of what one of their officials had omitted to do in 1909, the
intiffs were now estopped from raising the point. The plaintiffs
d that their Act enabled them to supply the borough and the town-
ip of Whitley and Monkseaton; and the agreement with the defen-
nts cited that the latter should take the whole of the supply required
the urban district. Since then, some additions had been made
the defendants' district. In December, 1911, defendants inquired
ether plaintiffs would be prepared to supply water to the added
ea. The reply was that the existing agreement had reference only to
e area of the district at the date of the agreement; but they were pre-
red to negotiate an agreement on a different basis. No arrangement
s reached; and the negotiations were broken off in September, 1912.
t in February last year they were re-opened, when the plaintiffs
scovered that the defendants were already using the water for the
ded area. An offer was made to the defendants; but this was not
cepted, and they were continuing to take the water from the gravita-
n main, thereby making considerable profits. The defence inferred
at the defendants were encouraged to lay their communication main;
e plaintiffs knowing full well that they were entitled to supply the
ded area. He submitted that it was not reasonable to expect that
ey were to supply the urban district of Newbiggin, however large it
ight become.

Mr. Page, in the course of the arguments, intimated that the defence
thdrew the plea of estoppel.

His Lordship, in giving judgment, said it was impossible to suppose
at the plaintiffs knew a supply was being given to an added area,
hen at the time they were contending that the district of supply was
e original district, and were demanding very much higher terms for
second area. On the question as to the constitution of the district,
said that in his opinion the Newbiggin urban district must mean the
iginal district. One definite area was marked as the area to be sup-
ied. It would cast a burden on both parties if the agreement was to
deemed to extend to a district that might be twenty times as large in
e future. He gave judgment on the construction of the agreement in
e plaintiffs' favour.

Mr. Romer suggested that the injunction should be granted and sus-
ended for six months, to give the defendants time to make arrange-
ents for a supply of water for the added areas, and that in the meantime the supply should be at the rate of 7½d. per 1000 gallons, without prejudice. With regard to the water already used, the plaintiffs were willing to accept nominal damages.

After some discussion, the damages were fixed at £5; and it was agreed that water for the added areas should be paid for at the rate of 6d. per 1000 gallons—the defendants to fix meters. The injunction was to be suspended for six months.

MISCELLANEOUS NEWS.

SIR CORBET WOODALL'S CHRISTMAS GREETING

To Gas Light and Coke Company Co-Partners.

The following Christmas Greeting from the Governor (Sir Corbet Woodall, D.Sc.) occupies the first page of the December issue of the Gas Light and Coke Company's "Co-Partners' Magazine."

Again I rejoice in the opportunity of wishing all co-partners "A Happy Christmas."

To-day, as at Christmas last year, we are living in an atmosphere of strife, and cruelty, and suffering, which is at the same time one of splendid effort and noble self-sacrifice. Last year we knew something of the greatness of the war; but imagination did not reach to what it has now become.

We and our Allies are fighting on many fronts—even over the reputed Garden of Eden, the cradle of our race. Millions of men are engaged upon the various fields in Europe, Asia, and Africa; and millions more are striving with all their strength in the workshops of the world in preparing guns, munitions, food, and clothing for the soldiers and the sailors.

We of the Gas Light and Coke Company are working among the rest; and it is for each and every man of us, whether in the front or at home, to satisfy himself that he is leaving nothing undone that is possible to him. We have to win the war; to fail would mean the break-up of our Empire and the reduction of Great Britain to the condition of Belgium or Serbia. We must win the war, if only to punish those who have so richly deserved punishment. To do this, will mean the putting forth of every effort we can make.

Especially to those at home I would say, "Think constantly of our brothers, our sons, our friends, and what they are doing abroad and at sea; and let us solemnly vow to leave nothing undone that is possible to us to cheer and help them on to victory." When the end comes, and victory is won, it will be well if, amid all our sorrow and all our pride in the lost ones, we knew that we also have done our best.

And so, with Tiny Tim on his Christmas Day, I pray—

"God bless us every one."

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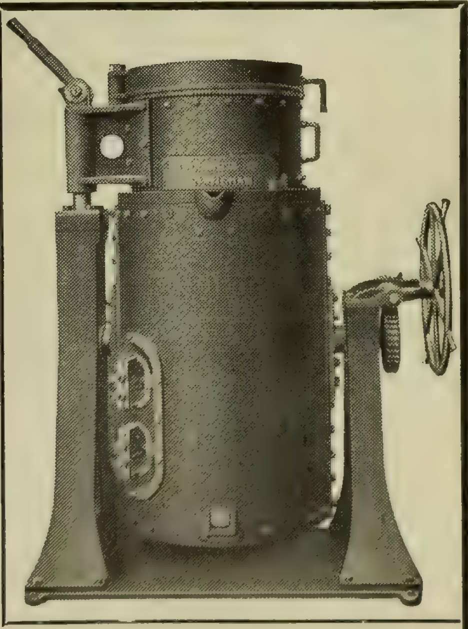

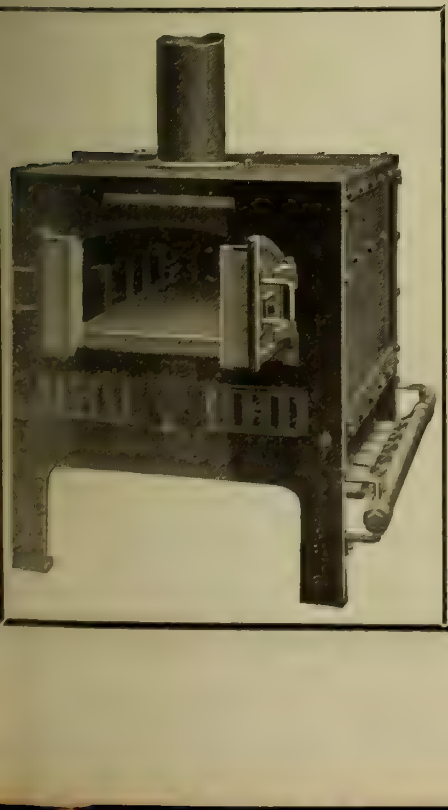

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GAS-WORKERS' DISPUTES.

Some time ago, the Barnsley Gas Company's employees, without having first obtained the consent of their Union Executive, handed in their notices; and when this was brought to the attention of the District Secretary (Mr. C. H. Blackburn), he did what he could, by opening up negotiations with the Company, to avert a stoppage. Interviews took place with a view to a settlement; but these being unsuccessful, both parties agreed that the matter should go to arbitration. The proceedings took place recently at the Company's offices, in the presence of Mr. Doughty, of the Industrial Commissioner's Department. The case for the men was put by Mr. Blackburn, and that for the Company by Mr. E. G. Lancaster (the Chairman), and Mr. H. Hutchinson (the Engineer and Manager). After the conference, the works were visited by Mr. Doughty, who promised to give his decision at the earliest date. It is expected that a satisfactory settlement will be arrived at; and meantime the men agreed to remain at work.

At Paisley, the gas workers who recently went on strike, refusing the Town Council's offer of arbitration in connection with their claim for an increase of wages, subsequently returned to their employment, having agreed to the Corporation offer. During the strike the stock of gas was maintained by the military; and before the workers returned it had been largely increased. The pressure, which had to be cut down owing to the deficiency caused by the suspension of work, was raised again as soon as the soldiers had the works in full operation.

At the week-end, considerable inconvenience was experienced at Aberdare, owing to a strike at the gas-works. Evening services were interfered with on Sunday; and at the railway station and in the signal boxes lamps and candles had to be requisitioned. The gas-workers ceased working on Saturday morning; and their demands were conceded during the day. They refused, however, to re-start until the fresh terms were embodied in a new agreement.

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LEIGH (LANCS.) GAS AND WATER SUPPLIES.

Reports on the working of the Leigh (Lancs.) Corporation gas and water undertakings for the year ended March 31 last have been presented to the Gas and Water Committee by Mr. James Gibson, the Engineer and Manager.

The gross profit for the year on the Gas Department was £9865, being 5·36 per cent. on the capital invested in the undertaking. After deducting sinking fund and interest charges, £10,080, equal to 1s. 3·75d. per 1000 cubic feet of gas sold, there was left a loss of £215, which was further increased owing to special charges having been met—viz., £160 for slot-fittings, £45 for depreciation of meters, and £71 for allowances to workmen on military service—leaving a net loss of £491. During the year 257 new services were laid. At the beginning of the year the were on the register 2618 ordinary and 6841 prepayment consumer and by the end of the year ordinary consumers had decreased by 45, 1·71 per cent., while prepayment meter users had increased 273, 3·99 per cent. Thus the total number of consumers at March 31 la was 9687—an increase of 228, or 2·41 per cent. The number of publ lamps was increased by 20, to 905; but of these, on March 31, on 472 were in lighting.

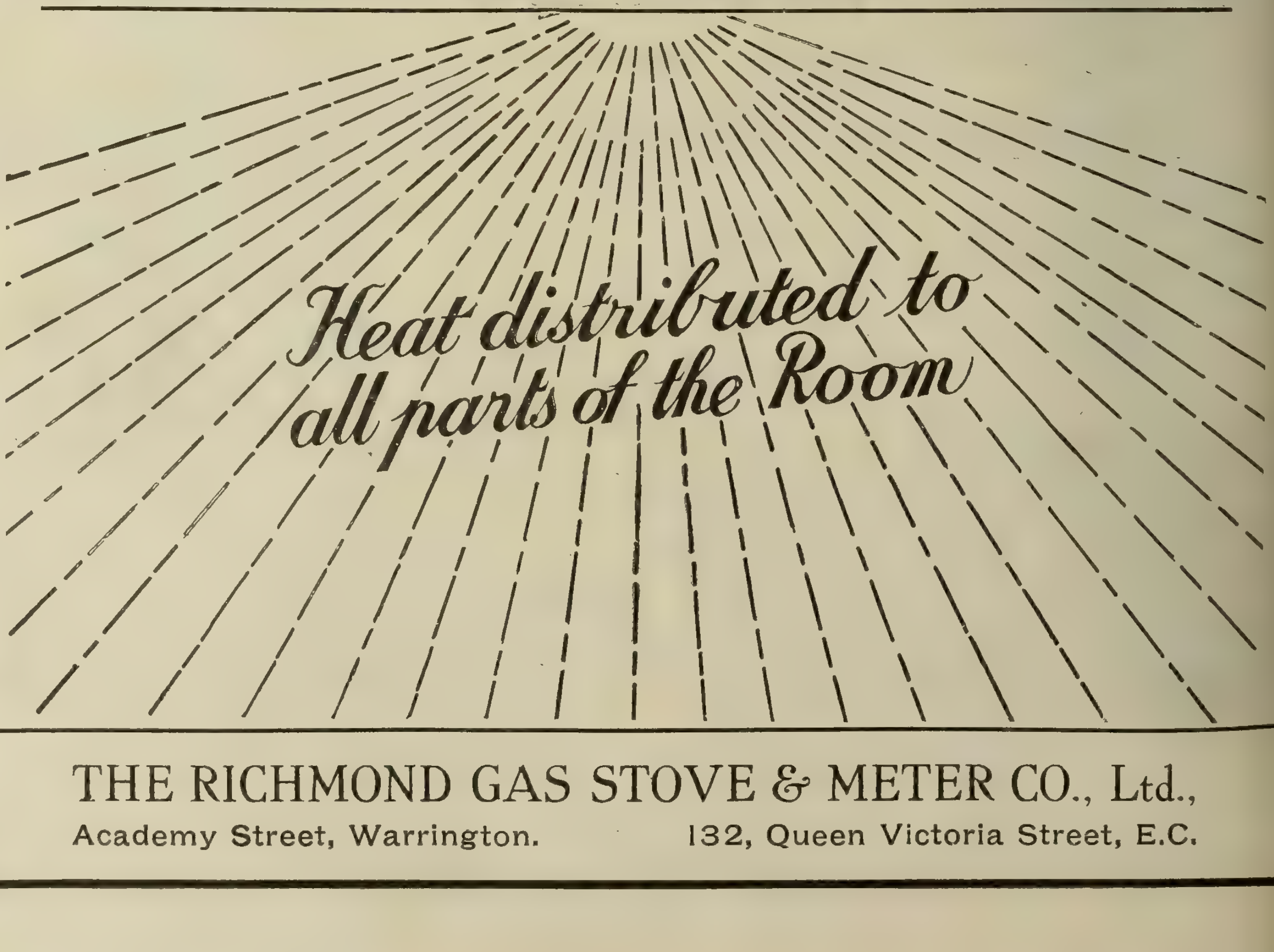
The coal carbonized in the twelve months amounted to 15,035 ton while the quantity of gas sent out was 165,344,000 cubic feet, or decrease of 2·03 per cent. on the preceding year. The decrease consumption was largely due to the War Office lighting conditions pr vailing in the borough. At the end of the financial year, there were gas-engines connected with the mains; and during the twelve montl 2,253,900 cubic feet of gas were sold for power purposes, as compare with 1,869,700 cubic feet the year before. The total quantity sold fo manufacturing purposes was 4,294,500 cubic feet. The make of gas p ton of coal carbonized was 10,800 cubic feet, and the sale 10,030 fee This was considerably less than in the preceding year; but the diffe ence may, Mr. Gibson says, be accounted for by the new retorts nc having the proper heats, caused by the defective draught of th chimney, thereby producing less gas per ton of coal, and also by th change in the collections from slot-meters from three to only two pe quarter.

The loss on the undertaking, compared with 1913-14, is accounte for as follows: Decrease in price of gas for power and manufacturin purposes, and also to prepayment consumers, £232; loss on residua —sulphate, tar, and coke, £977; increase in interest and sinking fun charges, £174; increase in price of coal, oil, carting, &c., £249; an increase in repairs and maintenance caused mainly by the preparatio and starting of the vertical installation, £403. During the curren year there has been an increase in the price of coal of 5s. to 5s. 6d per ton; but there will be some slight reduction in these prices, owin to the passing of the Coal Price Limitation Act. In consequence c the increase in the price of coal, the Committee increased the price c gas 6d. per 1000 cubic feet from July 1.

At the close of the financial year, the capital invested in the work (excluding the cost of a scrubber-washer, exhauster, and carburette water-gas plant) was £184,062, or at the rate of £12 4s. 10·14d. pe ton of coal carbonized, £1 2s. 3·17d. per 1000 cubic feet of gas made and £1 3s. 11·67d. per 1000 feet sold.

The revenue account of the water undertaking shows a loss of £93 as compared with a loss of £573 for the previous year. The tota quantity of water received during the year from the Liverpool an Manchester Corporations was 300 million gallons. The houses an other premises supplied on assessment were 8839, and by meter 791 Taken on the population supplied—*i e.*, 45 000—the consumption pe head per day was 18·12 gallons; and leaving out the water used b meter for trade purposes, the quantity was 14·14 gallons per head pe day for domestic purposes.

Richmond's New "R.H.D." Gasfire.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AUTHORIZED PLUMBERS' CERTIFICATES.

A Question at St. Helens.

s it legal for municipalities to publish lists of authorized plumbers? s question has lately been engaging the attention of the Institute Plumbers, because of the refusal of the Water Committee of the Helens Corporation to recognize the Institute's certificate of com ency. The Water Committee only take cognizance of the certifi- e of the Worshipful Company of Plumbers, and they accordingly ulate for this. When a certificated plumber belonging to a well- own Manchester firm was instructed to execute certain plumbing rk at St. Helens, they intimated that they would decline to give upply of water, unless the work was carried out by a holder of the tificate of the Company of Plumbers—notwithstanding the fact t the contractor employed held the first-class honours certificate of City and Guilds of London Institute and was also certificated by Royal Sanitary Institute.

The Institute of Plumbers having repeatedly sought an interview h the Water Committee without success, have now taken advice on legal aspect of the question; and they have been informed that a vsuit would probably succeed. But a final decision as to an appeal the Courts has been deferred for the present, in order that the lest information may be available. It is felt that the St. Helens ater Committee have not acted reasonably in declining to hear deputation from the Institute. Discussing the matter, Councillor rkenshaw, of Oldham, remarked that the St. Helens Corporation ve definite powers for the authorization of plumbers; but he was ormed that, if work is done in accordance with the bye-laws, there s no power to stop it being connected-up. If a public supply of ter was refused, the Corporation, he was told, would be liable for mages.

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GAS SUPPLY AND HIGH EXPLOSIVES.

[From the "Eastern Daily Press," Norwich.]

References to the part that gas supply is taking in helping the State successfully prosecute the war, may have been observed in the Press om time to time; and it has doubtless come as a surprise to many ople to hear that extracts from coal gas play such an important part raw material for the production of high explosives. The question ll pass through many minds as to how coal gas is affected, and what the nature of the extractions.

To answer the last question first, we may say that benzol and toluol e the two chief products required; benzol having a chemical com- sition of 6 atoms of carbon and 6 atoms of hydrogen, while toluol ntains 7 atoms of carbon to 8 atoms of hydrogen.

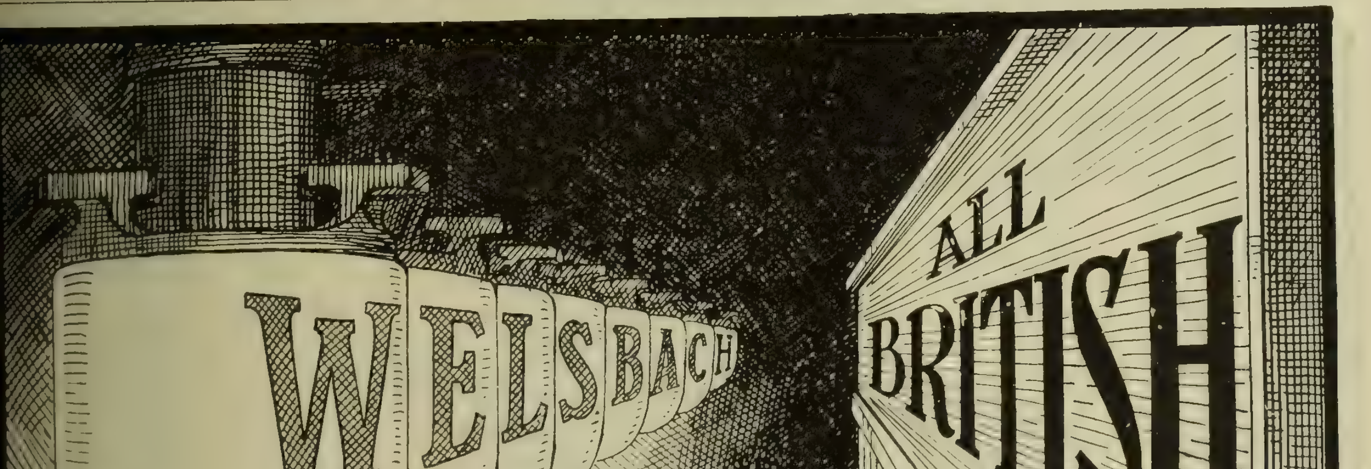
These constituents of coal gas are present as a vapour under ordinary conditions; but when extracted and rectified they have the physical properties of a spirit, and are comparable in many ways to petrol, for which they can be used as an efficient and more powerful substitute. Petrol, however, cannot be used in place of benzol and toluol for the production of high explosives. The vapour of benzol and toluol, when present in small quantities in gas, gives that luminosity to the flame with which we were familiar in times past, before the introduction of the mantle burner and the electric glow lamp. There can be few of the self-luminous flame burners in use now; and this is fortunate, as it allows of greater freedom on the part of gas supplying authorities to comply with the demands of the State, without danger of injuring the interests of the large number of people who consume gas. As we have said, there are few luminous flame burners now in use. Those consumers who have clung to this now obsolete method of obtaining artificial light will do well to replace them by the more economical and efficient mantle burners, which use blue atmospheric flames, like those on cooking and other gas-heating appliances.

What will happen when the war is over, and the War Department no longer require urgent supplies of spirit? Will the gas-works become the source of supply of motor spirit, and so save purchasing from abroad? This is likely to be the case, and gas consumers will in the end get the benefit of these changed methods of manufacture and use of gas, as it is a well-established policy adopted by gas companies to allow their customers to share the benefits of any economies and improvements that may be made.

◆

Increase in Price at Lincoln.—On the recommendation of the Gas Committee, the Lincoln City Council have resolved to increase the price of gas 3d. per 1000 cubic feet; this being the second increase during the year, and bringing the price to 2s. 6d. Alderman White stated that the price for electricity would also have to be raised on Jan. 1.

Money Sanctioned for Retorts at Stafford.—With regard to the recent fire at the Stafford Gas-Works, the Chairman of the Gas Committee stated at last Tuesday's meeting of the Town Council that the damage would not be so extensive as was at first feared. A Sub-Committee had been appointed to ascertain, if possible, what was the origin of the fire, though he was not sanguine of success. Just before the outbreak of war, the Gas Committee submitted a scheme to the Local Government Board for the extension of the gas-making plant by the erection of new retorts and a new holder. The scheme was approved by the Board; but their sanction to the borrowing of the money was withheld. Representations have lately been made to the Board that the provision of the retorts is absolutely necessary, not only for maintaining the gas supply of the town, but for the production of material for the manufacture of explosives. It was intimated at the Council meeting that the Board have now sanctioned the raising of £20,000 for the retorts.



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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 13.

Pitch remains unchanged at 20s. net per ton. Creosote is quoted 4⅛d. to 4¼d. net in bulk; solvent naphtha, 2s. 2d. naked; anthracene, 40-50 per cent., 2¼d. per unit, casks free—all *ex* makers' works. Benzol, toluol, and carbolic acid are still under official control. Some contracts for freed-tar for use on the roads during next season are now being placed.

Sulphate of ammonia continues very strong, and £16 10s. net per ton has been paid for 25 per cent. quality, filled into buyers' bags at makers' works, for prompt delivery.

⁂ In last week's report, the price of creosote was, through a printer's error, given as 4½d. instead of 4¼d.

Tar Products in the Provinces.

Dec. 13.

The market for tar products is still very quiet. Distillers in some instances are willing to accept the low prices which are ruling for pitch at the present moment. Creosote is being offered at low figures. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 11.

Throughout the week the market for this material has continued without interruption its upward course, and another record in high prices for the past thirty years has been established. The exports for the last month show an increase of 5686 tons as compared with those for November, 1914, and there has been no slackening in the demand from abroad for shipment from now up to April next. The closing quotations for December delivery are £17 per ton f.o.b. Hull, £17 5s. f.o.b. Liverpool, and £17 7s. 6d. f.o.b. Leith. In the forward position, values have moved in sympathy with those for near delivery, and it is reported that business has been done at the best ports at £17 10s per ton for January-March, £17 for April-June, and £16 10s. for July December.

Nitrate of Soda.

The market for this material has also advanced further, and holder on spot now require 14s. 10½d. per cwt. for ordinary, and 15s. 10½d. fo refined quality.

Sulphate of Ammonia.

From another source, it is stated that there has been a further rise i the market for this article during the past week. Outside London makes to-day are quoted at £15 12s. 6d. to £15 15s.; Hull, £16 12s. 6d. Liverpool, £16 15s. to £16 17s. 6d.; Leith, £16 17s. 6d.; Middles brough, £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade is steady, and deliveries are fairly good But there is not now much coal free for sale for the rest of th month; so that the tendency of prices is firm on the whole. In th steam coal trade, best Northumbrians are from 20s. to 21s. per to f.o.b. for prompt supplies; second-class steams are about 17s. 9d. pe ton; and steam smalls vary from 10s. 6d. to 12s. 9d. per ton, according to the quality. Work at the collieries is fair, when the number of me enlisted is taken into account. In the gas coal trade, the tone is stead generally; the home demand being now at its fullest. Best Durha gas coals are from 19s. 6d. to 19s. 9d. per ton f.o.b.; for second-clas gas coals, the quotation is about 17s. 6d. to 17s. 9d. per ton; an "Wear Specials" are 21s. per ton. Shipments of gas coals to the Metro polis are full; but those to France are not so heavy. To Italy, the congestion at some of the ports is checking the deliveries. The freigh market is rather easier; but gas coal from the Tyne to London i 15s. 6d. to 16s., and to Rouen 26s. has been paid. As the output o coal will be less for the latter half of the month, shippers will find tonnage more readily; and while gas coal will have a stiff demand, freight may show ease till the year has turned. In the coke trade, there is a heavier demand, and the exports are now above those of a year ago Gas coke is firm, though in larger production, and the price quoted for good makes is from 27s. 6d. to 29s. 6d. per ton f.o.b. in the Tyne.

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There is a proposal by the Glasgow Corporation to purchase the Thornliebank Gas-Works from the Calico Printers' Association. When the Glasgow Boundaries Bill, which included Thornliebank in its scope, was promoted in 1912, the Corporation agreed to purchase the gas-works. The village was, however, removed from the Bill, and the agreement was not carried out.

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Gas-Works Requirements at Lancaster.

n behalf of the Local Government Board, Mr. A. W. Brightmore
Thursday held an inquiry into an application by the Lancaster
poration for a Provisional Order to enable them to borrow money
gas-works and other purposes. As to the gas undertaking, the
ncil desired the alteration of their Act of 1880 so as to enable them
orrow a sum not exceeding £80,000 for extensions. The Town
k (Mr. T. C. Hughes) said that the Corporation asked immediate
tion to borrow £28,000—for carburetted water-gas plant £7895,
nstruction of retorts £9698, working balance £10,000, and con-
encies £7000. Mr. C. R. Armitage (the Gas Engineer) gave a
ey of the works; pointing out that in 1880 the make of gas was
00,000 cubic feet, and last year it was 238,616,000 feet. The car-
izing plant produced 1,060,000 cubic feet per day; and the demand
for 1,048,000 feet per day. It was proposed to expend £2625 on
ers and fittings for new consumers, and £1600 on new mains. The
nstruction of No. 2 retort-bench, with the carburetted water-gas
t, would produce 1,800,000 cubic feet. As the result of previous
nsions, practically nothing of the old plant remained. The whole
been reconstructed and brought to its present capacity without
ng a penny to capital account, except for the purchase of land.
y had spent over £72,000 out of revenue. The price received for
in 1880 was 4s. 6d. per 1000 cubic feet, less discount; and the
ge to-day was 1s. 9·17d.

* * *

Fatal Acetylene Explosion.—Bernard Drury, aged 69, a gardener,
ucklechurch, died from injuries caused by an explosion in connec-
with an acetylene plant. At the inquest, it was stated that some-
g went wrong with the apparatus, and Drury started to attend to it.
re was an explosion, and he was found unconscious 35 yards away.
tions of a lamp were found near him. The building in which the
t was installed was wrecked. Apparently the accident was caused
aulty connecting-up after charging the apparatus.

Price of Gas at Chesterfield.—In view of the heavy rise in the
e of coal, the Chesterfield Gas and Water Board have pointed out
the increase of 4d. per 1000 cubic feet in the charge for gas to
nary consumers will only about half meet the additional cost to the
rd. The Gas Committee say: "We have felt that in these expen-
times we would keep the increase as low as possible, hoping that
he increased sales of residuals we may be able to meet the high
e of coal. The Committee have taken advantage of the Price of
l (Limitation) Act, 1915, and have been able to get a small reduc-
on the basis of the prices paid two years ago." The financial
ement shows that £251,766 was raised for the purchase of the gas
water undertakings and costs of transfer, while £165,483 had
e been raised for additional works and extensions, making a total
417,249. The amount paid off is £128,968, leaving a balance
ng to March 31 last of £288,281. The gross revenue for the
financial year was £56,227.

Importance of Show-Rooms.

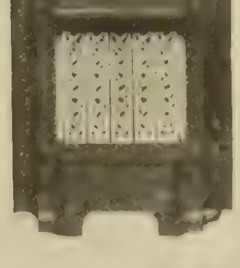
Alderman Lowe (Chairman of the Gas and Electricity Committee) replied at some length at last Wednesday's meeting of the Burton-on-Trent Town Council to a question that had been previously raised as to the cost of the working of the show-rooms, and whether the results fulfilled the expectations of the Committee. He stated that the gas show-room cost £250 per annum, and the electricity show-room £100. There was to be added to this the interest on the money invested in the building of the show-rooms and purchase of the site, which might mean another £250, or a total of £600. It would be very difficult to say that they had made £600 as a result of the premises; but the Committee were satisfied that they were meeting requirements. The factors raised by the war—such as economy—had to be taken into consideration before saying that the show-rooms did not come up to the expectations formed when they were commenced. They were not able to push trade as in the past, because all the fittings were purchased out of revenue; and they were not able this year to place anything on one side for this purpose. As an instance of the results of the show-rooms, he said that, though there were but eleven electric fires when they were opened, there were about 163 at the present time, which indicated increased revenue. There had been an announcement in the Press of a petition signed by a number of ratepayers who desired to enter a strong protest against the continued use of the bottom shops of the museum for purposes which brought no result to the ratepayers. It was strange, but it seemed the only people who could manage an undertaking had nothing to do with it. Nearly all gas concerns in the country had show-rooms, and found the necessity for enlarging and developing them. In many towns gas was produced by private companies, who had shareholders to satisfy, yet they had expensive show-rooms, and realized their importance for furthering trade. The money spent on the show-rooms was spent in very much the same way as large manufacturers expended money in advertising. He hoped that the public would be reassured, despite the fact that it was not always apparent, that the money spent came straight back. The Committee went into the matter fully at the beginning. The figures he had given included the heating and lighting of the show-rooms. The placing of gas-fires commenced two years ago; and since then between 600 and 700 had been fixed.

* * *

German Plan for Obtaining Benzol.—Speaking at an inspection of the Manchester Corporation electricity works last week, Alderman William Kay (the Chairman of the Gas Committee) remarked that for three years prior to the war German firms had endeavoured wherever they were allowed in this country to instal coke-plants, in order to obtain benzol for exportation to Germany. They offered to put down the plant without any capital expenditure to the English firms; and the scheme was undoubtedly financed by the German Government, who were anxious to obtain the benzol for the purpose of extracting from it toluol for the manufacture of explosives.

The "LOUVAIN."

The "LILLE."



The "MONITOR."

MANUFACTURERS:

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EXETER.

Telegrams: "VULCAN, EXETER."

Barrow-in-Furness Municipal Undertakings.—The Barrow Corporation "Blue-Book" shows that there has been spent on the gas-works £170,750, of which £58,024 has been repaid. The water-works have cost £433,482; and £117,189 has been redeemed. The electricity works have entailed an outlay of £158,480; and loans amounting to £50,147 have been paid off. Including all Corporation undertakings £1,690,623 has been spent on property, permanent works, &c.; and of this, £493,363 has been redeemed.

Home Office and Lighting Restrictions.—The suggestion that the restrictions regarding lighting are being carried out with unnecessary rigidity at Nottingham was repudiated at a meeting of the Corporation, on Monday of last week, by Sir J. T. M'Craith (the Chairman of the Watch Committee), who said that, with the Town Clerk, he had had an interview a few days previously with one of the principal Home Office officials. They were given to understand that, far from the present arrangements being relaxed, they might be made even more stringent than at the present time. The Chairman pointed out that, if the regulations were ignored, municipalities stood in jeopardy of losing the Government grant towards the support of the police, which in Nottingham amounts to £16,500 a year.

Public Lighting of Yarmouth.—In the course of a discussion, at a meeting of the Eastern Sub-District of the Institution of Municipal and County Engineers, on a paper dealing with "Wartime Economy," a communication was read from Mr. J. W. Cockrill, of Great Yarmouth, who said that £5600 was spent in street lighting in Yarmouth; but the Committee, before the present lighting regulations, reduced this to £4000. The lighting regulations turned out every lamp; but as there were capital charges and repairs to be met, the cost would now be £1500—reducing the bill by £4000. He thought that, as the public had found it possible to live without so much light, it was very likely it would be some years before the lighting bill again reached £5600. Mr. H. Collins remarked that at Colchester the cost of public lighting had dropped from £3578 to £315; and the men had been placed on other work.

Nottingham Water Committee's Responsibilities.—A report relating to the Nottingham Corporation Water Committee's responsibilities as to certain easements over the late Sir Charles Seely's estates, adjoining the Bestwood and Papplewick pumping-station, was dealt with at a meeting of the City Council on Monday of last week, when it was determined to ask the Executors to terminate an agreement under which, for 21 years, the City has been paying £150 annually for a technical trespass on Sir Charles's land in respect of a heading from the Bestwood pumping-station which has been abandoned, and a further £150 annually in regard to a projected heading from the Papplewick station which had never been made. Correspondence which had passed on the subject was read, and in one of the letters the Water Committee pointed out that they had paid £1575 for nothing and £1725 for very little. The Corporation had contributed £5200, which they considered ample compensation for a technical trespass.

Power Gas Corporation.—The operations of the past year show total profit of £20,743, to which has been added £7479 brought forwar from the previous account, making altogether £28,222. Out of this, i is intended to place £1140 to the reserve fund, and to pay a dividen of 6 per cent. per annum upon the ordinary shares, less income-tax There will remain a balance to be carried forward of £9105.

Water Charges in Manchester.—It is proposed by the Mancheste Corporation Water Committee, subject to the approval of the Cit Council, to increase the charges for water to an extent which will ad £29,000 a year to the income of the department. This step is neces sitated by the increased rate of interest on loans and the genera advance in the cost of labour and materials. The suggestion is to rais the minimum price for the supply of water by meter in the city fro 4·85d. to 6d. per 1000 gallons; while outside the city the price is to b raised from 6d. to 8d. It is intended also to reduce the compositio allowed on weekly property within or outside the city, of the annu value of £10 and over, from 20 per cent. to 5 per cent. The Commit tee further propose to reduce the charges for water supplied to loc authorities to 5¾d. per 1000 gallons, from 6¾d. as regards Wigan, an 7¼d. in the case of other authorities.

Increased Price Notified at Portsmouth.—The Portsea Island Ga Company announce that, having arranged contracts for the prese year's requirements of coal and oil on favourable terms soon after th outbreak of war, the Directors have been able so far to continue th normal price of gas; but in view of the very great increase in the co of these and all other materials and labour for the coming year, the are now reluctantly compelled to advance the charge. To consumer supplied on the ordinary system, from the date of reading the meter for the current quarter or month, the price will be 2s. 8d. per 100 cubic feet within the Borough of Portsmouth, and 2s. 10d., 3s. 1d 3s. 4d., and 3s. 7d. in different out-districts. With regard to co sumers on the prepayment system, throughout the district the rebat in respect of gas consumed will be withdrawn on the 31st inst.

Gas Light and Coke Co-Partnership Scheme.—Referring to th co-partnership balance-sheet of the Gas Light and Coke Company t June 30 last, the "Co-Partners' Magazine" remarks that the influenc of the war is apparent in the figures. The number of co-partners h declined from 9617 to 9452. Savings added to the withdrawab account have fallen from £6079 to £4419, and to the trust accou from £1195 to £391. The price of gas has had to be increased, fi to 2s. 8d., and then to 3s. per 1000 cubic feet; and consequently t bonus, instead of being 5 per cent., is at an average rate of 3¼ p cent. But against these results others can be set of a more encoura ing character. In broad results, the fund steadily progresses. T interest on bonus and savings in the withdrawable account is larger £380 than last year; and in the trust account it is larger by £93 The balance of the trust account, added to the amount of stock act ally held by co-partners, shows a total of £162,946, as compared wi £155,993. This is all to the good.

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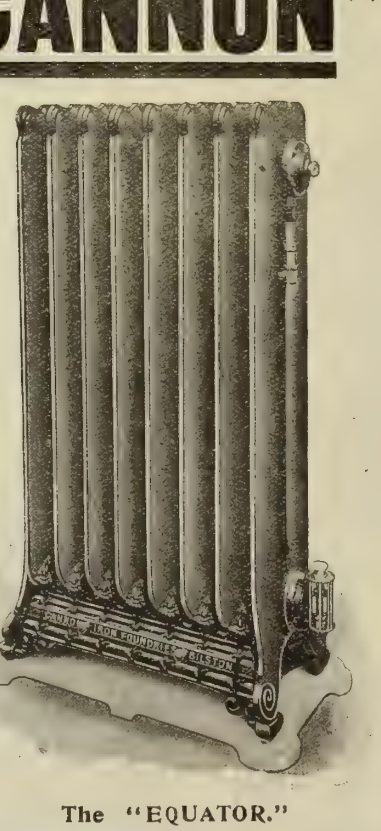

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Coal Famine in Vienna.—A Reuter message from Zurich dated Friday says that, owing to lack of coal, the supply of gas to nna is in grave danger of becoming exhausted. The Burgomaster appealed to the Prime Minister to use his influence in order to ble the municipal gas-works to obtain sufficient coal to avoid the l of the city being suddenly left in darkness. Laibach is already out light; the gas-works having no coal.

The Shortage of Copper Coinage.—It has been resolved by the ickham Urban District Council to send a letter to the Newcastle- Tyne and Gateshead Gas Company, asking for more frequent visits he houses where copper coins are to be found in the prepayment er boxes. The member who proposed this said he did so "because he delay in the visits, which was greatly hampering tradespeople ugh a shortage of copper. Week after week business was practi- y at a standstill through a shortage of copper."

Cowes Gas-Works Results.—It was stated at a meeting of the ves Urban District Council that the gross profit on the gas under- ng for the past half year was £1505; but when principal and rest charges were deducted, there was a deficiency of £93. At the of the year, it was declared, the ywould probably have a most sfactory report. One member said he was not at all satisfied with the ance sheet; but another pointed out that the increase in price was material assistance to them, while they were also making more gas ton of coal.

Public Lighting Question at Torquay.—At a meeting last Tuesday he Torquay Town Council, the local Chamber of Commerce for- ded a number of petitions asking for an immediate restoration of lighting of the town. Petitions were also presented separately by ieties and organizations of various kinds. The previous order to uce the lighting was suspended by an almost unanimous vote of the uncil; and the town will be lighted again as usual. It was explained t the restoration of the former lighting was resolved upon subject to powers that may be exercised by the military.

Scottish Farmers and Sulphate of Ammonia.—The following arks are made by the "Scotsman," on the subject of the supply of phate of ammonia to Scottish farmers: "The question of the supply sulphate of ammonia has been brought prominently forward by trict agricultural committees in several parts of Scotland. In this nection, it is of interest to note that, according to the Board of ade returns just issued, the quantity exported during the month of vember of this year amounted to 30,500 tons; while in the same nth of 1913, which may be regarded as a normal year, the exports ounted to 27,000 tons—showing that the export during the past nth has been 3500 tons in excess of the export of a normal year. e country showing the largest increase compared with 1913 is the tch East Indies, which took 16,850 tons, against 300 tons in 1913. rely, in face of these facts, arrangements will be made for a supply sulphate of ammonia at reasonable prices for spring cultivation. e supply given in November-December at £14 10s. per ton may have en of some use to farmers in the South, but it was absolutely useless Scotland."

Recent demands by the Bradford Corporation gas workers for vances in wages would mean an extra cost of £7200 per year. The atter has been referred to the Finance Committee.

The Gas Light and Coke Company's collier "Ignis," which carried oo tons, has been sunk. She is supposed to have struck a mine on e 8th inst. It is reported that the crew were safely landed.

The Accrington and Stockport Master Plumbers' Associations ve lodged protests with the Institute of Plumbers against the prac- e of the municipalities in those towns supplying and fixing gas pliances.

Several tanks containing creosote oil and naphtha were destroyed fire last Thursday, at the chemical works of Messrs. James Gibbs d Finch, Limited, Cattedown, Plymouth. The cause of the out- eak is unknown.

The present lighting restrictions should result in Messrs. D. Hulett d Co., Limited, of No. 55 and 56, High Holborn, W.C., experi- cing a good demand for their convenient range of japanned tin d cardboard shades for inverted burners. There is a side reflecting ape which should prove particularly useful.

Mr. F. Colburn, of Manchester, has been appointed Gas-Meter spector for the City of Birmingham, in succession to Mr. Thomas pinks. Mr. Colburn has served under Mr. S. Dyson, of the Gas- eter Testing-Station, Manchester, for seventeen years; and for the st ten years he has held the position of Chief Assistant.

Mr. E. P. Taudevin, of the Richmond Gas Stove and Meter Com- any, Limited, last week lectured before the Bradford Engineering ociety, at the Technical College, on "Gas-Heated Furnaces," illus ating his remarks with lantern slides. He made a special point of e use of gas-furnaces in the steel-works of Sheffield, particularly in e annealing of shells of all kinds.

Messrs. Emmott and Co., Limited, of Manchester and London, ave forwarded a copy of the "Mechanical World Pocket Diary and ear Book for 1916." It is the twenty-ninth year of publication of this rviceable little work—the price of which is 6d. net. The contents ave been thoroughly revised; and some of the numerous tables have een extended. There is a section on gas-engines; and the Diesel ngine on this occasion is separately dealt with. Further information n other subjects has also been introduced.

In regard to the proposed stoppage of works in connection with the uplication of mains between the Nidd Valley and the city, and other ater-works extensions, the Bradford Water Committee have decided, n view of the urgent request of the Local Government Board, to stop he works on Wharfe syphon and the construction of intakes at ngram reservoirs, and to undertake that only the most necessary ork should be proceeded with till the termination of the war. The reasury are to be asked to grant authority for the borrowing of a urther sum of £96,072; being the difference between money already orrowed and expended, *plus* the approximate amount required up to he end of the present financial year.

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being circular, radiates heat in all directions, while the products of combustion are collected by the dome-shaped canopy and conveyed from the room through the central flue in accordance with the Home Office Regulations.

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STOCK MARKET REPORT.

The Stock Exchange has had another quiet week, and the tone on the whole was dull, though different markets were under such various influences that no general description could embrace them all. Abroad, the situation in Serbia and in Mesopotamia was not calculated to impart strength; while at home the growing dissatisfaction in regard to the political aspect, the recruiting campaign, and other matters, indisposed commitments upon anything but a small scale. A pleasing point was furnished by the month's trade returns, which showed an increase in our exports. Home Government issues weakened almost up to the close, when a moderate recovery was welcomed. Home Rails continued weak, relieved only by some demand for the secured issues. Peculiar conditions in Wall Street, where there was much selling, flattened Americans down; and they dragged Canadian Pacifics with them, in spite of the very satisfactory traffics. South Africans were under a cloud; and the good things in the Foreign Market had a set-back. Even shipping and the other plums of the miscellaneous group received a check. Perhaps the attractions of the French loan led to some amount of selling, even of high-class securities. The next British War Loan is not generally expected before the close of the financial year, and large amounts of Treasury Bills are being taken up. Further modification of Stock Exchange regulations was made by the Committee in regard to "physical possession" of securities, thereby facilitating dealings with New York; and measures in regard to commissions were taken to protect members against outsiders. The Banks' commission question will stand over. Business in the Gas Market continued to be on a very light scale. As a general rule, prices did not show much variation (if any) from the figures which have been ruling recently; but some were difficult to understand in the absence of knowledge as to the circumstances attending them. Gas Light and Coke preference one day marked widely divergent figures, and on another Commercial 3½ per cent. changed hands at a higher price than the 4 per cent. The easy condition of the Money Market remained unchanged.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 73½, 74¾, ditto debenture 62, 62½, 62¾, 63, Imperial Continental 84½, 85, Primitiva preference 3¾, South Metropolitan 78½, 79. On Tuesday, Continental Union 38½, Gas Light ordinary 73¾, 74, 74¼, ditto debenture 62¼, 62½, 62¾, Imperial Continental 84, Primitiva preference 3¾. On Wednesday, Gas Light ordinary 73¾, 74, Imperial Continental 84, Liverpool 93½, Monte Video $9\frac{7}{16}$, Oriental 100, Primitiva preference $3\frac{11}{16}$, $3\frac{13}{16}$, Tottenham "B" 96¼, 96¾. On Thursday, Liverpool 93, Monte Video $9\frac{5}{16}$, 9⅜, South Metropolitan 79. On Friday, Gas Light ordinary 73¾, 74, ditto preference 73, 73½, 75, 75½, ditto debenture 62½, 63, Imperial Continental 83, Oriental 99, 99½, 100, Primitiva $2\frac{15}{32}$, 2½. On Saturday, Commercial 4 per cent. 75, 77, ditto 3½ per cent. 76, Gas Light ordinary 74⅛, Imperial Continental 83, 83½, South Metropolitan 69.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

Messrs. Henry Faija and Co. are, as from the 25th inst., removing their testing works and chemical laboratories to more commodious premises at No. 6, Earl Street, Westminster.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	..
874,000	"	July 10	[illegible]	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd. . . .	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water { 10 p.c. . .	29—30	5 6 8	..
873,480	10	"	7	7/-	B 7 p.c. .	15—15½	4 10 4	..
95,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Deb. . .	..	—	..
880,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3	..
330,000	"	"	†11	55/-	Do. New . . .	204—209	5 5 3	..
50,000	"	"	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb. .	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	7¾	Do. A Ord. Stk. .	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4 6	Do. 4½ p.c. Pref. .	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	75—77
560,000	"	"	5⅓	46/8	Do. 3½ p.c. do. .	103—105	5 1 6	76
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	..
800 000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	38½
200 000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk. . . .	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk. .	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke { 4 p.c. Ord. . .	98—102	4 15 6	73½—74¾
2,600,000	"	"	3½	3½	3½ p.c. max. .	76—79	4 8 7	..
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10	73—75½
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	62—63
130,000	"	"	10	10	10 p.c. Bonds .	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C . . .	151—154	5 2 4	..
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	5 12 6	83—85
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. { A	211—213	4 13 11	93—93½
718,100	"	"	7		B	146—148	4 14 7	
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	4/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne } 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	6 13 4	$9\frac{5}{16}$—$9\frac{7}{16}$
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2	99—100
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B . .	128—131	4 19 8	..
100,000	50	"	12	60/-	Do. C . .	118—121	4 19 2	..
52,000	50	"	10	—	Do. D . .	..	—	..
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	6 18 4	$2\frac{15}{32}$—2½
499,960	5	June 26	5	2/6	" 5 p.c. Pref. .	4¾—5	5 0 0	$3\frac{11}{16}$—$3\frac{13}{16}$
521,600	100	June 2	[illegible]	4	" 4 p.c. Deb. .	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8	..
209,984	"	"	10	10	Do. B	222—224	4 9 8	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	78½—79
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	[illegible]	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	"	"	5	5	Do. 5 p.c. Pref. .	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent. .	..	—	..
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District { A 5 p.c. .	135—138	5 8 8	..
742,275	"	"	6	6	B 3½ p.c. .	115—117	5 2 7	96¼—96¾
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	[illegible]	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅝	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/3	55/1½	" C 3½ p.c.	110—115	5 2 0	..
352,000	"	"	6⅛	57/6	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	"	"	6⅝	63/9	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

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OURNAL OF GAS LIGHTING & WATER SUPPLY.

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VOL. CXXXII., No. 2745.] TUESDAY, DECEMBER 21, 1915. [67TH YEAR.

EDITORIAL NOTES.

Gas Consumers and Toluol Extraction.

HE fruits of the injudicious publication that was made by rious local authorities of the request of the Ministry of unitions that they should do everything possible to protect om attack gas undertakings engaged in extracting benzol d toluol from their coal gas, are being experienced in e shape of more or less agitation in some districts on the rt of consumers who fancy that the value they get in gas r their money is being seriously depreciated. In some of e very districts in which there have only just been heard e sounds of inchoate agitation, extraction of toluol from e gas has been proceeding since the spring; and yet til apprised of the matter through the papers, the con- mers were quite unaware that anything unusual was oceeding. For instance, there has been a meeting of a raders' Association within the past few days in the district Balham and Tooting, at which all sorts of most ridiculous ings were said about the supply of gas, and claims made at consumers should receive some compensation for the terioration occasioned to the gas by doing something that indispensable to the prosecution of the war. In this se, the Gas Company were one of the first to advance to e help of the Government in this matter of recovering luol and other necessaries to the manufacture of high xplosives. Yet we undertake to say there was scarcely a nsumer until nearly nine months after the work of extraction started who had any knowledge that a portion of certain the constituents of the gas was being removed.

However, the speeches at the Traders' Association meet- g in question were of a random order, and betrayed con- picuous ignorance of the matter under discussion. The rocess of extraction as practised in that particular district the one almost universally applied in connection with gas ndertakings. If the process were an oil one, and no steps ere taken to enrich the treated gas, there would be ground r complaint. But it is not so, and, apart from knowledge s to the actual small depreciation in heating power, we now from day-to-day practical experience in the area of e same Company that there is no occasion for complaint. t seems to us, under the circumstances, and as the idea ay spread that some real disadvantage is being occasioned he consumers, that they should be taken into confidence, hrough articles in the local press or by circular-letter, as to hat is actually being done, and so promptly put an end to iscontent. Last week (p. 605), we printed an extract from n article designed for public educational purposes, and ublished in the "Eastern Daily Press." By this article he gas consumers in the area in which the paper circulates ere informed as to why the gas is being treated, that by he process the luminosity of the gas is partly affected, that very modest percentage reduction represents the deterioraion of the calorific power, and that, in consequence, only the sers of antiquated flat-flame burners are materially affected. The consumers should be told these things. They should be nformed, too, that, if anything, a keener flame is secured n the incandescent burner owing to improved aëration; and brilliant light from the mantle is thus realized. Also hat the heating power of the gas is prejudiced only to a egree inappreciable in practice. As a matter of fact, he London County Council returns as to the calorific power of the gas supplied in the area from which members of the Balham and Tooting Traders' Association are drawn, show that both before and since the toluol extraction process was set to work, the average gross calorific value of the gas has been between 550 and 560 B.Th.U., which proves how wholly without foundation is the complaint.

If consumers knew of the importance of the work in relation to the war, any complaint as to supposed injury would be immediately hushed; if they knew how little they were actually suffering when properly using the gas, there would be no further talk of compensation by a reduction of the price of gas. There seems to be some singular idea abroad that gas companies are making a fabulous fortune out of this toluol extraction business, which, of course, they are not. It would be a good thing for the consumers if gas companies working under the sliding-scale were doing so; for, if they were, and the profit balances on the whole trading permitted it, the consumers would be the largest beneficiaries. But profit and loss accounts and dividends tell a tale different in actual fact from the imaginings of some consumers. There appears, therefore, to be every reason why, under the circumstances, consumers should be informed as to the actualities, and that the present insensate mystery should end. It is doing more harm than good.

Freights, and British Gas Capital Abroad.

THE gas industry at home has accepted quite philosophically all the adversities brought upon it by the war, other than when, as in the case of coal and freights, it has been felt that it was the victim of a control exercised by cupidity with striking arbitrariness. Then the industry has turned, and has sought, through the supreme powers, the relief that its administrators have believed should be forthcoming. But though, as a result of persistence and combined action with other industries, coal prices have been regulated, the market rates of freight have not. Looked at in the best light, the regulated price of coal is bad enough, but coastwise freights have placed a burden on many undertakings of a weight that is having somewhat grim results for them and their customers. A Committee has been appointed by the Government to look after the requisitioning of tonnage for foodstuffs, &c., and to prevent freights on such commodities rising to prohibitive rates; but no effect has yet been seen. Freights have continued to ascend; and they show a firmness at top figures that is the reverse of pleasant. That is the position at home. Matters are worse elsewhere. Some people are consoled by learning that there are others in worse case than themselves; and if there are any such in the home gas industry (we hope not), they will find a plenitude of consolation in the conditions of the Union des Gaz in the fortunes of which the Continental Union Gas Company are so deeply concerned. The story, dark and dismal, and with no trace of a silver lining, was told last Tuesday by Mr. George Touche, M.P., at the meeting of the Continental Union Company. The story should be read by all who think the conditions of their own undertaking are bad enough; but, instead of deriving consolation from it (other than thankfulness that their own circumstances are not of such present blank hopelessness), there will be sympathy with those who have to direct and manage a gas concern under such obdurate conditions.

Just think of this: The Union des Gaz have to ship to Genoa, for use at the gas-works there and at Milan, about 360,000 tons of coal a year. Normal freight is something like 8s. per ton from the Tyne. Four or five months after the war started, the rate was 20s. to 22s. 6d. per ton; and since then it has gradually mounted up (with a temporary recession in the summer months) until last week it was standing at 66s. and 66s. 6d.—more than eight times the pre-war normal! Without considering the extra cost of coal, the increase of 58s. in the freightage means nearly 5s. extra upon the cost per 1000 cubic feet of gas produced, calculating on a yield of 12,000 cubic feet per ton of coal. This increase, if it continued over a year, would mean on 360,000 tons of coal £1,044,000! We do not anticipate that any such perpetuation of this extraordinary state of affairs will be allowed; but even 30s. increase in freight over the normal means upwards of half a million of money on the 360,000 tons. Such rates would, said Mr. Touche, strain the resources of the strongest institution. And this is only a bad instance of many other deplorable experiences in which British capital invested in gas undertakings abroad is having its value squeezed out of it by fearful rates of freight, which Mr. Touche is satisfied—and so is every other sane disinterested man—are not justified by the limitations of tonnage alone. But the calamitous tale does not end with freights. When the coal had reached Genoa, a further difficulty was, through shortage of waggons and labour, to get the steamers unloaded; and expense through delay—the greater the delay, the greater the expense—is piled up.

Still the black state of affairs does not end. The Company cannot possibly transfer all the extra cost to the consumers (it would mean a collapse of business if they tried to do it); and gas is being supplied to-day at heavy loss. And what is far from creditable to the Milan Municipality, they appear to have been doing everything possible to prevent the Company sharing with consumers the additional cost of keeping the supply of gas going. The Municipality have shown a well-cultivated subtleness in deferring the time when the Company could ask the consumers to contribute to the extra expense. The time for raising, and the extent of an increase in, the price of gas is not a matter that is left, as in this country, to the determination of the administrators of the gas undertaking. An increase in the price of gas due to an advance in the cost of coal is a matter which, under certain conditions in which the Municipality are concerned, has to go to arbitration. But here the Company are at this period of the war still dealing with the evasions and delays of the Municipality in respect of the arbitration. Instead of the latter allying themselves with the Company in endeavouring to alleviate the perverse circumstances by helping to produce quickly a distribution of the effects, they have done all in their power to frustrate any such action—indeed, their attitude, and the suggestions that have emanated from them, have not been what one would have expected from the governing body of such an important city in an allied country. Had Milan been in Germany, instead of in Italy, we could have appreciated the attitude and methods of the Municipality. What makes matters worse is that the delay is producing for the Company irremediable harm. Any one part of this tale is bad enough; taken in the whole, it is almost beyond appreciation, excepting by those who are actually involved in dealing with such a cataclysm of appalling circumstance. By comparison, the worst conditions to-day of any one gas undertaking at home are really easy and comfortable.

Reverting to the freight question, what is now happening cannot be allowed to endure. It is a question that exceeds in importance many of the topics with which our politicians concern themselves. That is Mr. Touche's view; and, as a member of Parliament, he is in close contact with these matters. But the Government does not appear, for some unfathomable reason, to be so keenly moved by a condition of things that is nationally uneconomic, in that it enhances considerably the cost of living for the community and industry. "Traders are faced with disaster, commercial "losses are enormous, British trade is being undermined." And why? One word supplies the answer, "Freights." Mr. Touche appears to fear that the Government cannot be readily absolved from responsibility for the present condition of affairs, on account of the waste of tonnage, and the ill-use made of it, that has obtained, according to report, in the Transport Department. Inquiry and investigation are urged—now, and not when it is too late to be of material service. Does any member of Parliament seriously think it would be an easy matter to get a public inquiry which would convict a Government Department, in connection with the war, of gross incompetence and of inflicting irreparable injury upon the country through its trade and commerce?

The Excessive Temperature of Gas-Fires.

We live and learn, and simultaneously obtain fresh evidence that it is a somewhat common failing to say the wrong thing at an inopportune time. Professor A. H. Barker has been lecturing, at University College, upon "Domestic Electric "Heating;" and he evidently wanted to say something that he thought would please his electrical audience. Therefore, according to one report, he mentioned that the gas-fire has been developed "to such a pitch of efficiency that the "temperature attained by the glowing fire-clay fuel is too "high and too scorching for the body-warming work it is "called upon to perform." This is not what electricians desired him to say; for various electrical writers of "tech-"nical" papers, correspondents of the electrical press, and certain volatile journalists have expended much ink in asserting the precise contrary. The efficiency of the gas-fire ha been low, the flight of B.Th.U. up the chimney has been i the region of 80 per cent., and altogether the poverty of th gas-fire as an effective heating agent has stood in strikin contradistinction to its cost. Either Professor Barker i wrong as to the high heating efficiency of the gas-fire, or hi electrical predecessors in the pronouncement of an opinio on the subject are altogether at sea. The contradiction wi require some explanation from those predecessors. Of course Professor Barker is right upon the point of high efficiency and so the electricians must be wrong. These misinforme men could never be brought to state by what scientific o other means they had arrived at their determinations, whic entirely ran counter to the results derived from precis methods by highly skilled experimenters. The defence, o rather the attempted defence, of their assertions, has neve been forthcoming. But Professor Barker tells us that th efficiency to which the gas-fire has reached has run so hig as to cause the radiants to attain a temperature that is excessive and scorching. This is very curious, because from the gas-fire it has never been claimed that the radiant efficiency (ignoring convected heat) exceeds 50 per cent., or few points above or below. Assume an electric radiato giving an equal amount of heat to a room as a gas-fire, th area of incandescent surface from which the radiations tak place in the case of the gas-fire will be considerably large than that of the electric-radiator; and therefore the intensity of temperature of the incandescent area will be muc higher in the case of the latter than the former. But lookin at the matter from the practical standpoint, though the gas-fire is a more effective heating agent, and less costly than th electric-radiator, we have never experienced that scorchin through the concentrated temperature of which Professo Barker makes a point; and the great popularity of th modern types of gas-fire does not suggest that householders and other users find any inconvenience from them However, Professor Barker urges manufacturers of electri radiators to avoid the mistake of providing too intense radiation. They cannot very well avoid this per unit o area if they really wish to heat a room. If the temperature of the fuel is too intense in connection with a gas-fire then all that has to be done is to manipulate the gas-tap t bring it down to more comfortable conditions. It was a excellent home truth with which the Professor assailed hi audience almost at the very outset of his lecture, that chie among the obstacles which hindered the development o electric radiators is their high cost in comparison with othe methods of heating.

Pooling Private Railway Waggons Deferred.

The proposal for pooling private railway waggons—whic was the subject of comment last Tuesday, and of a letter b Mr. J. Ferguson Bell, as well as one by Mr. H. L. Johnso to-day—has been largely discussed during the week, an protesting resolutions have been forwarded to the Board o Trade from all parts of the country, and to the Chairman o the Coal Organization Committee of the Home Office (Si Richard Redmayne). But the best news is that owners o private waggons may breathe freely again for at all event the time being. Something has had a good effect in persuading the Board of Trade that a scheme of this kind is on that should not be consummated without proper notice, an without careful and comprehensive consideration of all th *pros* and *cons*. The good intelligence that there is to be dela and consultation before dealing with the matter was supplie at an interview that a joint deputation from the Waggo Builders' Association and the Association of Private Owner of Railway Rolling Stock has had with Mr. W. F. Marwood of the Railway Department of the Board of Trade. It i reported that definite assurance was given by him that n steps would be taken in the matter of the pooling of privat waggons during the present parliamentary session, and tha subsequent to the session there should be consultation wit the various interests before anything positive was done The scheme, however, having been introduced, owners o private waggons will make use of the opportunity provide by the postponement to, on the one hand, consolidate thei position and prepare a good defence, and on the other t effect such arrangements that, if perchance the scheme doe eventually go through, the damage to private owners wil be lightened. It may be that the Board of Trade will dro the proposal, and search for another scheme for improvin

tters; but this cannot be taken for granted. What is re-
red is the better utilization of the railway companies'
ggons; and this is a point on which Mr. Johnson makes
uggestion in his letter this week. However, it looks as
ugh the proposal as to the confiscation and pooling of
vate railway waggons so far as it had gone was an ill-
ested affair, and that the Board of Trade had not ex-
ted the disturbance of such a large hornet's nest about
ears.

ining for the Gas Profession.

At intervals for some time past, there has been a demand
the drawing-up of a detailed scheme of technical training for
ng men entering the gas profession; and it has more than once
n suggested that the Institution of Gas Engineers might take
work in hand. Such a scheme would be of inestimable value
a guide to young men desiring to qualify for a place in the
fession, and for adoption by universities and technical colleges
schools that aim at providing special courses for giving young
a broad and solid foundation for their training and practical
k as gas engineers. Though there has been this demand, the
ncil of the Institution do not appear to have worked-up suffi-
t enthusiasm to take the subject in hand. But perhaps time
see this done. When—if ever—they do take up the matter,
will find that the Manchester School of Technology has
ady provided a scheme upon which they can work. To this
eme Mr. James Macleod, of Greenock, calls attention in our
orrespondence" columns this week; and, like him, we tender
rtiest congratulations to the Manchester District Junior Gas
ociation for any part they took in producing this plan for
ematizing training. As a scheme, it ranks among the best—
bably it would not be far wrong to say "as the best," for the
simple reason that there has been nothing put forward that
roaches it in extent of detail. In his letter, Mr. Macleod says
the scheme is not faultless; it would be an extremely fine
eme of this nature that was not. But it has the merit that it
plies a groundwork; and there is nothing to prevent a concen-
ion of brains upon it to effect improvement. How great the
d for a systematized scheme which shall help in this matter
raining is clearly seen by the remarks (published in this issue)
le by Mr. Samuel Glover, the Examiner in "Gas Engineering,"
Mr. Walter Hole, the Examiner in "Gas Supply," on the
k of the candidates in this year's City and Guilds examina-
s. We have examinations, which Mr. Thomas Glover, in our
e for Nov. 2, showed could be made more valuable; but the
paration of the candidates for those examinations is proved
hemselves to be gravely defective. However, this is a sub-
that should not in the interests of the industry be left where
. Mr. Macleod also suggests that a student who has gone
ugh the Manchester course and taken a certificate, and also
a position as assistant in a gas-works for two years, should
iven the degree of associate member of the Institution. A man
had made himself master of the subjects included in the course
ld deserve greater honour—anyway until all the members of
Institution had given proof that their knowledge was superior
hat of the "certified by examination" associate member.

am-Roller Troubles.

The steam-roller in this country has at various times and in
erent places been a source of much annoyance both to gas
ertakings and gas officials; but one does not very easily
to mind a case in which the cause and effect were so curious
hose in connection with an occurrence which was recently
ore the Kentucky Court of Appeal. The steam-roller pure and
ple is bad enough; but in this particular instance the machine
both a roller and a road scarifier—the latter function being
formed by the aid of steel spikes fixed in the rear wheels, and
ovable at will. The road was a wide one—part macadamed,
part soft; and while the machine was being moved, with the
es in position, on the soft part of the road from one stretch
macadam to another, without interfering with the intervening
ch, the spikes pierced a gas-main, the escaping gas came in
tact with the fire in the engine, and an explosion resulted.
man operating the engine was badly burned; and he brought
action for personal injuries against the gas company owning
main. It seems that when the pipe—an 8-inch wrought-
one $\frac{5}{16}$-inch thick—was laid, it was placed at a fair average
depth below the surface; but obviously at the spot where the accident occurred it had either been laid very near the surface or else the covering had got removed. On behalf of the company, it was argued that the county officials knew the main was in the road; but the Court held that, whether or not they knew of the closeness of the main to the surface, was not a material factor in the case. The company's other contention was that the law did not impose upon them the duty of maintaining gas-pipes so far below the surface, or so strong, as to prevent them being punctured by the spikes in the wheels of such a machine as this; and that the act of wheeling the spikes over the soft part of the road could not have been reasonably anticipated by the company. In a lengthy judgment, however, the Court held that it was the duty of the company to guard against injury through proper use of the road; and that the operation of this machine (with spikes 4 inches long in the wheels) on the soft part of the road was not negligent. In the first Court, the case was not allowed to go to the Jury; but the Appeal Court decided that it was for the Jury to say whether the gas company could reasonably have known that their main was so near the surface in some places, and have foreseen the danger that might arise from such a machine being used. So there is to be a new trial.

Federation of Employers' Associations.

A thoroughly practical step has been taken for consolidating the industrial interests of the country through the employers, and for producing an effective organization for advancing the common interests in many ways. There was a private meeting last week, at the Westminster Palace Hotel, of representatives of (it is stated) "almost all" of the industries of the country, at which it was agreed to create a Federation of Employers' Associations, which, it is hoped, will bring the industries, as well as scientific and financial interests, into co-operation. Some people appear to think this is an answer to the great labour combine regarding which an announcement was made in our columns last week; but this is denied—in fact, one of the purposes of the organization is to attempt to effect greater harmony between capital and labour, which the gas industry has shown is not impossible if only the effort is directed into the most effective channel. The new organization has other lofty aims. Foremost is the affording of means for bringing "the industrial interests of the country as a whole into closer touch with the Government—not in any spirit of hostility, but with a view to achieving complete and cordial co-operation between the State and industry for the national advantage." Another purpose will be to bring into co-operation the Parliamentary Committees of the existing great Federations of Employers, in order the more effectually to deal with problems that affect them all. An organization such as this would have been invaluable in the crisis at the outbreak of war.

Coal and Coke Exports.

The Board of Trade returns for November show that the quantity of coal exported during the month was 3,302,771 tons, compared with 5,913,404 tons in November, 1913, or a reduction of 2,610,633 tons. In November last year, the reduction on 1913 was 2,633,244 tons; and last month the quantity exported was greater by 22,611 tons than in November, 1914. France was again the largest outside buyer of our coal; its requirements exceeding those of the previous two years. In November, 1913, our Ally took from this country 1,031,427 tons; in 1914, 1,036,949 tons; in 1915, 1,388,211 tons. Had France not taken the additional 352,000 tons, the total exports last month would have been under 3 million tons. The returns show that the coke exported last month amounted to 110,946 tons, compared with 126,307 tons in November, 1913, and 100,202 tons in November, 1914.

Christmas Holidays.

The next number of the "JOURNAL" will, in consequence of Boxing Day, go to press a day later than usual—on Tuesday instead of on Monday—and will be published on Wednesday. All communications intended for this issue should, however, be forwarded as soon as convenient.

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At last week's meeting of the Society of Engineers, Mr. Percy Griffith was elected President for next year, and Messrs. H. O. Adams, W. B. Esson, and W. N. Twelvetrees, Vice-Presidents. The membership was stated to be 588, with 83 affiliated members.

CHIEF ENGINEERSHIP OF THE SOUTH METROPOLITAN GAS COMPANY.

Appointment of Mr. G. M. Gill.

We are in a position to state that, at last Wednesday's meeting of the Directors of the South Metropolitan Gas Company, the long-open position of Chief Engineer was filled by the appointment of Mr. Geoffrey Murton Gill. As is generally known, Mr. Gill is at the present time Assistant Engineer to the Commercial Gas Company—a post to which he was promoted some two-and-a-half years ago. He entered that Company's service in 1901, as Mr. H. E. Jones's pupil. After having spent four years at the Poplar works, he was appointed Assistant Manager at the station; and in 1908 he became Engineer and Manager of the Wapping works. Since his appointment as Assistant Engineer, he has been engaged in the management of the Stepney works, the formation of a Coke Sales Department on a largely increased scale, the supervision of certain work in connection with the district department, and in general administration work.

Hearty congratulations and good wishes will be extended by his many professional and private friends to the new Chief Engineer of our progressive South London Gas Company, on this further big step in an already successful career. Mr. Gill (who is the son of Mr. John Blackett Gill, the late Chairman of the Commercial Gas Company) obtained a First-Class Certificate with honours in "Gas Engineering" at the City and Guilds of London Institute in 1905.

PERSONAL.

As the effects of the war, and the bombardment of the town, have resulted in an enormous decrease in the Company's business, the Directors of the Scarborough Gas Company have decided to dispense with the services of their Works Superintendent, Mr. J. F. Smith, who has been with them during the last 9½ years.

Three South African nephews of Mr. George Hands have just arrived in England, after serving in General Botha's German South-West Africa campaign. Mr. R. H. M. Hands and Mr. P. A. M. Hands will remain with the Cape contingent that has come to join one of our fronts for further active service. The third, Mr. K. M. Hands, an engineer by profession, is seeking a commission with the Sappers. They are sons of the Mayor of Cape Town.

It is, says the "Eastern Daily Press," interesting to note the manner in which Mr. W. J. Carpenter's brothers and sons are doing their bit in connection with the war. His brother, Warrant-Officer George Carpenter, is serving as a chief carpenter in the Royal Navy. Another brother, Mr. A. A. N. Carpenter, is the Manager of the City and part Southwark District of the Metropolitan Munitions Committee (appointed by the Ministry of Munitions); and a third, Mr. B. A. Carpenter, in connection with the manufacture of high explosives. The last two were pupils at the Gas-Works, Southgates Road, Yarmouth. With regard to his sons, Lieutenant George E. Carpenter and Leonard Carpenter (recently joined) are serving in the Royal Engineers; Second-Lieutenant W. N. Carpenter is with the Royal Garrison Artillery, and C. C. Carpenter with the British Red Cross (Beccles) as a Section Commander. The senior, Mr. W. J. Carpenter, who is the Manager and Secretary of the Great Yarmouth Gas Company, is following a similar line to that of his brother, dealing with the requirements of the Ministry of Munitions. This constitutes the whole male section of the family.

At the conclusion of the ordinary business of their meeting last Thursday, the Hebden Bridge and Mytholmroyd Gas Board presented to Mr. E. J. Wellens (the late Manager) a framed testimonial, signed by the members of the Board, and recording their high appreciation of the valuable services which Mr. Wellens rendered during the twelve years he was in office. It also sets forth in detail the improvements and extensions which have been carried out under his supervision. The Chairman (Mr. J. Simpson, J.P.) said that since Mr. Wellens took charge many difficulties had been met. He found the works in a very rough state, but left them in an excellent condition. For about twelve years, Mr. Wellens had served the Board faithfully and well. Other members also spoke of the good service rendered by Mr. Wellens; the Clerk (Mr. R. Crabtree) said that when the Board took over the works in 1895, they were little better than a scrap heap. Since that time, the output of gas had increased from 46 million cubic feet to 106 millions per annum. Mr. Wellens, in returning thanks, expressed appreciation of the support he had had from the Board. He was quite satisfied with his work at Hebden Bridge, knowing it was to the advantage of the ratepayers. The cost of gas had been greatly reduced; Hebden Bridge being one of the first towns to sell gas at 1s. 9d. per 1000 cubic feet for power purposes. After the presentation Mr. Wellens was entertained at luncheon.

It is reported that the Standard Oil Company, of California, are producing benzol and toluol on a small commercial scale. Secrecy is maintained as to the methods applied in producing from the Californian crude oil, which has an asphaltum base.

OBITUARY.

The death took place on Oct. 23 of Herr Karl Andre, the Engineer of the Corporation Gas and Water Works of Würzburg He had risen to this position from the workmen's ranks, havin been 36 years in the service of the Corporation.

The "Journal für Gasbeleuchtung" announces the death, o the 21st ult., of Herr Anton Breuer, Works Manager and Chie Clerk of the Rhenish Water Company. Born in 1851, decease had qualified as an engineer at the Cologne Gas and Wate Works, and had managed in turn the gas-works at Hagen an Borken and the water-works at Oberhausen, where he was engaged when the undertaking was acquired by the Rhenish Company into whose service he then passed.

Last Friday's "Engineer" records the death, as having take place on Sept. 23, of Mr. Robert Samuel Lloyd, one of the Directors of Messrs. Hayward-Tyler and Co., Limited. Mr. Lloyd who was long a member of the Institutions of Civil Engineer Mechanical Engineers, Naval Architects, Electrical Engineers, an Water Engineers, was born in 1856. In 1877 he joined the firm and was for many years Managing Partner of the works at Luton which were greatly extended under his supervision. He designe and carried out many important installations of pumping machinery at home and abroad, and took an active part in the variou Institutions to which he belonged. He was also well known an much respected at St. Albans, where he lived for many years.

The scientific world has sustained a great loss by the deat from heart failure on Saturday of the Right Hon. Sir Henry E Roscoe, F.R.S., whose research work as a chemist has been o extreme importance. Born in London in the year 1833, he studie chemistry first in Liverpool High School, and later went over t Heidelberg, where he was pupil and assistant of Bunsen. I 1857, he was appointed Professor of Chemistry in Owens College Manchester; and during the many years he spent there, number of his students became first-rate chemists. It was in 1885 tha he severed his connection with Owens College to enter Parliament; and he was then elected by the Council Emeritus Professor—shortly afterwards becoming a Governor. He was Vice Chancellor of the University of London, at the time of the transformation of the University from an examining into a teachin body. The Government frequently sought his services in connection with scientific matters. In 1881 he was appointed one of th members of the Royal Commission on Technical Education whic led to the passing of the Technical Instruction Acts of 1889 an 1890. For his services on the Commission he was knighted in 188

An Industrial Fuel Committee.

The Executive of the British Commercial Gas Associatio being desirous of securing all available information respectin the successful application of gas to industrial processes, with view to being able to render assistance to members in developin the industrial fuel side of the industry, have appointed the following members to form an Industrial Fuel Committee: Messr A. E. Broadberry, G. Clarry, R. S. Halkett, George Helps, R. S Hilton, A. B. Roxburgh, H. M. Thornton, C. M. Walters, an H. James Yates, with the Chairman of the Executive (Mr. F. W Goodenough), and the Secretary (Mr. W. M. Mason). In makin the announcement in the December issue of the "Bulletin, "F. W. G." says: "While the war continues, it will be difficult t obtain from over-worked managers with depleted staffs the detailed information that will be needed for establishing such comprehensive index of installations as would be of very rea value to all members. But members are invited now, and at an time, to furnish any information they possess, and to apply fo any information they need."

A New Lighting Order for Vehicles.

A new Order, to come into force on the 10th prox., has bee framed under the Defence of the Realm Regulations, to apply t vehicles. It makes important restrictions, and will supersede a the Orders on the subject now in force in England and Wale except the Order for the Metropolitan and City police district Part of the Order deals with the reduction of lights on vehicles i those areas where bright lights might serve to guide hostile ai craft. The complete list of these areas which is given in the firs schedule of the Order will relieve drivers from the difficulty the have hitherto experienced of knowing where lights had to be reduced. The general effect is that in the areas where these restrictions apply the use of headlights is prohibited, but sidelight are allowed of sufficient brightness to afford a reasonable drivin light for ordinary speeds. It is found, however, that sidelight which can be allowed on country roads are a source of danger i towns, where the large number of lighted vehicles makes the line of the main streets visible to aircraft; and it has therefore bee necessary to require sidelights to be further reduced in large town in the eastern counties. In the case of electric and acetylen lamps, this is to be done by placing over the front of the lamp or inside the front glass, a perforated cap or disc. A list of th towns where these special restrictions apply is given in the Orde Arrangements are being made to indicate, by distinctive signs o street-lamps, the boundaries at which the cap or disc must be use An arrangement will be made (using a different sign) to indicat the boundaries of towns where headlights must be extinguished.

ECTRICITY SUPPLY MEMORANDA.

A New High Efficiency Lamp.

: electrical industry is not going to give up hopes of making her advances in their lamps any more than is the gas in- try. There are claims that a fresh success has been achieved; but whether or not this is so, time and experience must furnish the proof. The lamp has been developed—not by a stroke of luck or happy inspiration, but steady persevering work, in face of many disappointments, he research laboratory of the Edison and Swan Company 'onders End. The object which the investigators sought to in was the making of a lamp having all the characteristics of ordinary electric incandescent lamp as regards shape and size ulb, stem, and cap, but having as the source of light an arc. cess is claimed, in the production of an enclosed arc lamp in ch the arc is struck between tungsten electrodes in an atmo- ere of nitrogen. A filament composed of tungsten, in com- tion with refractory oxides—such as zirconia, yttria, or ia—is employed to ionize in the gap between the electrodes, hat the arc can strike across. These filaments are said to longer than filaments of pure tungsten. A description of the p has been communicated to the "Journal of the Institution Electrical Engineers" by Mr. E. A. Gimingham and Mr. S. R. lard. From this it is learned that, in comparison with the on arc lamp, no regulating mechanism is required, and there erefore a saving in the initial cost of production. The loss ight due to obstruction by the electrodes, it is stated, is small ontrast with that in the carbon arc, and there is no trouble flickering or from the arc wandering. The arc is completely osed, so that there is no danger from fire. No re-carboning quired; and the lamp needs no attention while in use. The t-giving surface (concentrated in the centre of the bulb) for same output is greater than the crater of the carbon arc; and electrodes can be so arranged as to concentrate the light in desired direction. For high candle-power lamps the bulbs much smaller than for metal-filament lamps of corresponding lle power—*e.g.*, electrodes to give 500-candle power can, it is ed, be placed with safety in a 4-inch diameter bulb. A curve cates the efficiency for the normal working current to be about ndles per watt. Lamps have been made with a life of 500 rs; and during life the average decrease in candle power is to be 10 per cent. This is not a working life about which to st; and the intrinsic brilliancy—well, it "knocks spots" off ything in the electric incandescent line that has preceded it. compared with the carbon-filament lamp (1-candle power per watts), with an intrinsic brilliancy of about 375-candle power square inch, and metallic filament lamps giving 1000-candle er per square inch, the intrinsic brilliancy of the new lamp, n efficiency of 2-candle power per watt, is approximately oo-candle power per square inch. With such a highly con- trated source of light, the lamp may be useful for special, not for general, purposes. It is thought, however, that the ratory experiments show commercial possibilities.

he Fickle Current.

The electricity industry has been un- lucky lately in the luxuriant advertisement it has had of its unreliability of ply. It is a demerit that is always with it. But sometimes rojects itself on notice more than at others; and now that ories are so busy with munitions work, the owners of those depend on electrical energy have, where breakdowns have rred, been sorry for themselves. There was the fire not long e at the Belfast electricity station, which caused an inter- tion of supply. Disaster has overtaken the Dublin elec- ity supply station through an explosion. There was a break- n at Birmingham. On Nov. 17, a considerable portion of lverhampton was without current. On Nov. 30, there was a re of supply at Wednesbury; and it lasted quite an hour, ing which works relying upon electrical energy were largely ught to a standstill. At Wigan, there have lately been three ppages of the tramway supply; and these were capped by a eral failure on, above all times, a Saturday night. On the inst., there was a breakdown at the electricity works of the chley Borough Council. This was a Sunday; and from 3 p.m. 8 a.m. on Monday, the streets were (we believe electric light- is solely relied on) in complete darkness. The mishap being Sunday, those householders who, like the foolish virgins, had lected to make suitable provision for light in the event of a ure, were placed in an awkward position. We should like to rect the "Electrician" upon one point in connection with the akdown at Wednesbury. It says: "Owing to the breakdown Wednesbury, there was darkness for one hour." It should e added, except where gas is patronized. This qualification ays makes a very big difference; and it can be safely made, ause every electrical failure shows up in striking contrast the stancy of gas. People appreciate this constancy; and elec- ians cannot destroy by words such an obvious fact.

ifferences over a ed Price Agreement.

In last week's issue, in dealing with the electric lighting of certain artizan dwellings at Brighton, incidental reference was made to the Fixed Price Light Company, o prefer to hide their light under a bushel rather than tell the world how they are progressing financially. A paragraph appears in the electrical papers which indicates that the Wimbledon Council are contemplating ending their agreement with the Company, and getting rid of them if they can. But the Company, the agreement being in existence, appear to have the upper hand. Messrs. Handcock and Dykes are the moving spirits in connection with this piece of private enterprise; and they want to be satisfied that the Council have the power to purchase the Company's interests in Wimbledon, and they want payment, too, without any proviso or reservation. They also point out that the event of the agreement not being terminated by mutual consent will render it necessary for the Company to raise the price of current to the consumers, which is a nice look-out for the consumers, who have to all intents and purposes a contract in existence for a supply at the "fixed" price. Apparently the Company when they get a footing in a district are not easy to evict. There appears to have been some trouble between the Electricity Department and the Company as to transformer losses. The Committee have made claims for electricity lost in transmission through the Company's transformers; but the Company contend they are not liable, while the Committee decline to subscribe to the contention. There the matter remains so far as public intimation is concerned as to the position of the negotiations for the cleavage of the business relations between the parties.

Electricity v. Coke for Furnaces.

At the University College, London, Dr. J. A. Fleming has been dilating on electric heating. We are sorry the electrical papers have not given to these lectures something more than a mere statement of the ingredients of which the worthy Doctor composed them. However, in one part he told of the wonderful achievements in metal melting by electrical furnaces; but he proved conclusively—whether intentionally or not we are not informed—that in this country the electric furnace cannot compete with such a cheap fuel as coke. The price the lecturer put upon the coke is not known; but this is what we are told in a brief outline report: The lecturer pointed out that 16 cwt. of coke were needed to reduce each ton of pig iron, and of these $6\frac{1}{2}$ cwt. were required to deoxidize the iron ore, leaving $9\frac{1}{2}$ cwt. for heating purposes. In order to compete, the electric furnace would need to be operated with energy, which would not cost more than $\frac{1}{20}$d. per kilowatt-hour. At Niagara Falls energy could be purchased on a 24-hour per day basis at £2 to £2 10s. per horse-power-year, or approximately $\frac{1}{10}$d. per kilowatt-hour. The electric furnace, however, scored even on these figures where coal was expensive—for instance, in Norway and Sweden where it costs £3 per ton, but where the abundant water power furnishes electric power at a competing figure.

The War and the Maximum Price.

Electricity supply concerns in areas of residential character are feeling very acutely the pinch of current circumstances. As a rule, they have a straggling network of mains, and the connections per mile are few, and mostly to residential property, the occupants of which are on economy bent; while the local authorities have in many cases been compelled to largely reduce the public lighting. Meanwhile, the expenses of the electricity suppliers have risen considerably. Income has gone down, and outgoings have gone up, which are uncomfortable happenings. Many of these concerns in normal times have a perpetual and weary struggle for existence; where they are in the hands of local authorities, they derive financial sustenance from the poor deluded ratepayers. However, the Newquay Electric Supply Company have been suffering hardships in common with other concerns of similar character and environment. Under an old agreement entered into with the District Council (which agreement has no place in the Provisional Order, and is not therefore recognized by the Board of Trade), the Company arranged for a maximum charge of 6d. per unit to be inserted in their Order, instead of the customary 8d. But at that time a war of the magnitude and manifold effects of the present one was not even dreamed of; and after ten years' working, the Company find they cannot live decently on the 6d. price. They therefore applied to the Board of Trade for release from the 6d. and ascent to 8d.; but the District Council seemed to prefer that they should starve by being allowed only the dry bone of 6d. There has been an inquiry into the matter, at which it was said the costs of production had been increased by $2\frac{1}{2}$d. per unit, while the conditions occasioned by the war had put the Company into a worse position than ever for bearing additional expense. The Council resisted the proposed increase of 2d. in the maximum charge, though the Company gave an assurance that they had no intention of going higher than 7d., unless compelled to do so. It was stated during the proceedings that some consumers would not have installed the electric light had they known what it was going to cost them. This is not a new experience; and yet this is the day of metallic filament lamps. What those Newquay consumers would have said had carbon filament lamps presented the best efficiency and economy attainable in these days of increased expenses, would have been worth hearing. However, Mr. Roper was the Inspector; and he was in favour of peace negotiations. He is evidently an inspector who knows his business. After suggesting a compromise to the parties, he took the judicious course of going for a walk, and left them to settle their differences. On the Inspector's return from pedestrian exercise, it was stated that a settlement had been effected—a maximum price of 7d. for private consumption, with a reversion to 6d. at the expiration of one year after the war, but with liberty to the Company to refer to the arbitration of the Board of Trade the question of a higher price than 6d. per unit. If the Board confirm the maximum of 7d., the Inspector, Company, and Council will be happy; but probably not the consumers.

Another Awkward Agreement.

When electric supply companies enter into agreements such as that which has been as a millstone about the neck of the Newquay Company, especially during this period of war, they should provide against exceptional circumstances. The Electric Light Company carrying on business in Carmarthen find themselves in a similar uncomfortable situation. They, like all other enterprises and individuals, have suffered an increase in their expenses, and probably a reduction of revenue. But they have an agreement with the Town Council by which they cannot raise their price beyond 5d. per unit without the consent of the Corporation; and the hard-hearted Council will not release them from their obligation now that they desire to advance charges by 10 per cent. Exceptional circumstances, even where an agreement is concerned, should be taken into account. It has been so all along the line in the gas business during the war. In connection with public lighting contracts, gas authorities have allowed, where lighting restrictions are in force, a reduction in consideration of the smaller quantity of gas consumed, and allowances have been made to tradesmen with lamps supplied under contract. But there has not been universally the same amount of give-and-take in connection with the electricity supply business. In some instances, there has been proper consideration; but this has been far from general.

Contract Charges for Lamps.

Speaking of lamps supplied under contract, it has been frequently shown that electricity suppliers have not been very liberally disposed towards tradesmen who have lamps from them under contract, and have been compelled to extinguish them under the Defence of the Realm Act. In Poplar, the tradesmen are anxious to get a concession during the period in which they are obtaining no advantage from the lamps. But the hard-hearted Electricity Committee have decided that they cannot recommend any reduction on the fixed kilowatt charge—at present £8 for inside lighting and £6 10s. for outside lighting. The Committee, however, think the time opportune for striking a bargain with the users of these lamps, by suggesting that they should be allowed to purchase the installations if they elect to go on to the flat-rate system. They would be glad to let the installations go at the original cost, less 5 per cent. per annum for depreciation. If the users of the lamps are to pay the fixed kilowatt charge, they may just as well spend the money in buying the lamps.

AMSTERDAM WESTERN GAS-WORKS.

An Extension Scheme.

In the early part of this month, the Municipality of Amsterdam agreed upon the extension of the Western Gas-Works. Of the three large gas-works, two—the Western and the Eastern—were erected by the Imperial Continental Gas Association in the years 1882 to 1884, and were taken over by the Municipality in 1898. From time to time, they were modernized, and their equipment brought up to date. The Southern Gas-Works have an altogether new plant, started two years ago; and a description of it was given in the "Journal" dated Jan. 5 last.

Now that these Southern works, with the vertical carbonizing plant, have been in action without interruption for a couple of years, the system has proved to be absolutely reliable; and in view of the considerably decreased cost of gas production by the methods of working adopted, it is naturally desired that this decrease should be applied to a still larger bulk of gas. This can be done while making future provision for the ever-increasing demand for gas. The alternatives are the extension of the Southern works with new plant; the reconstruction and modernization of the Eastern works; or the reconstruction and modernization of the Western works. It goes without saying that the construction of new works, in addition to the Southern works, would be the most expensive course. This formed a reason for preferring one of the other alternatives—the more so as the distribution of a large quantity of gas is more easily effected from the Western works than from the Southern plant.

Modernization of the Eastern works is not advisable. They are almost completely shut in by dwelling-houses, and hardly any vacant ground is left. For hygienic and other purposes it is more than likely that there will be an effort in the future to stop this plant, particularly as the Southern works are not far distant. Capital outlay on the reconstruction of these old works would, therefore, not prove at all remunerative. Thus the Western works have been selected for reconstruction—a further advantage being that they are favourably situated on an ample site. Several firms have been invited to send in tenders for the reconstruction of No. 1 retort-house and additional plants; and the most favourable is by the Stettiner Chamotte fabric A. G., vormals Didier and Co., of Stettin, whose plans are similar to the Southern plant which was also constructed by the same firm. Their tender was therefore accepted. There is to be constructed a large tank o reinforced concrete, for the storage of ammoniacal liquor and tar; and means are to be provided for dealing with the dust in connection with the coal-breakers. The total cost of the work will be £145,832.

For the year 1914, the cost price of the gas produced in the Southern works was 17·272 fl. per 1000 cubic metres (8s. 2d. per 10,000 cubic feet). The cost price is taken as the cost of coals wages, &c., less the revenue from residuals, but without rent and depreciation. At the Western works, the cost price of the gas in the same period was 32·198 fl. per 1000 cubic metres (15s. 2½d per 10,000 cubic feet). When No. 1 retort-house of the Western works has been reconstructed, it is intended to follow the same system as with the Southern works—viz., to produce winter and summer the same bulk of gas by keeping regularly in operation the same number of retorts. No. 2 retort-house of the Western works and the Eastern works will have to provide the remaining quantity, varying with the season. The Southern works and the reconstructed No. 1 retort-house of the Western works are therefore each to produce per annum about one-third of the total gas made—viz., 34 million cubic metres, or 1200 million cubic feet For the Western works, where the difference in the cost of production is almost 8½d. per 1000 cubic feet in favour of the modern method, the reconstruction scheme will give a gross profit of over £41,000, or, with deduction for rent and depreciation and 12 per cent., a net profit of £24,000.

SIXTY YEARS AGO.

From the "Journal" for Dec. 10, 1855.

Companies or Municipal Bodies.—Is it more advantageous to the public that works connected with the supply of the imperative daily wants of an agglomerated population should be executed by the collective body, organized either as a municipality or a parish or by private traders? We place the discussion at once on this ground, because, notwithstanding the sentimental nonsense which has been uttered about trading in the wants and necessities of our fellow-men, we believe that the true solution is involved in the answer to the inquiry as to the most efficient manner of advancing public interests. Business is not romantic; and sentiment is out of place in discussions of this nature.

It is a trite observation, that the real end and object of every municipal or governmental interference with the ordinary affairs of life ought to be those of securing to the greatest number the greatest amount of happiness; and daily wants ought only to be brought within the scope of such interference when they can be more easily and justly supplied by means of the action of the general body than they can be by the spontaneous action o individuals. As a general rule, the latter is sufficient to meet our ordinary wants, whether these may be for water or for gas, clothing or bread, medicine or education. But, as it is impossible to lay down any invariable law in human affairs, and as the exercise of individual liberty may often lead to serious interference with the rights of other members of a community, it is often found necessary that a portion of the abstract rights of the few should be set aside, in order to ensure the general happiness of the community. Again, it does often happen that some of the wants of a highly civilized community are so universal that its members are alike interested in their satisfaction, and are equally bound to assist in securing the most efficient solution of the difficulties connected with them. The actual number of these wants is, however, very small. In all other cases, experience has demonstrated that open competition is the most satisfactory principle which can be allowed to regulate the demand and supply of ordinary life. It may happen, in some instances—whether on account of the capital invested or on account of its being necessary to grant to the undertakers of some peculiar municipal duty privileges of an exceptional character—that competition would be attended with inconvenience to the public. Should this be the case, it behoves the guardians of the interests of the community to adopt the requisite precautions; but fortunately such instances are rare and in an essentially commercial country like our own the evils arising from these causes do not long remain without a remedy—so far, at least, as the consideration of capital is involved.

The experience of all civilized nations goes to prove that precisely in proportion as the stimulus of private industry is withdrawn, so does the execution of duties of any description suffer.

Society of Chemical Industry and Munition Service.—A list published in the "Journal of the Society of Chemical Industry" of members whom the Minister of Munitions has engaged, and who are giving their services gratuitously, includes the following names: Professor P. P. Bedson, of Newcastle-on-Tyne; Dr. G. T. Beilby, of Glasgow; Mr. J. Ferguson Bell, of Derby; Mr. John Bond, of Southport; Mr. Charles Carpenter, D.Sc.; Professor J. W. Cobb, of Leeds; Mr. A. M'I. Duckham, of Westminster; Professor Percy F. Frankland, of Birmingham; Mr. Thomas Hardie, of Newcastle-on-Tyne; Mr. Percy S. Hoyte, of Plymouth; Mr. James M'Leod, of Greenock; Sir Boverton Redwood, of London; Mr. Octavius Thomas, of Pentre; and Mr. John Young, of Hull.

ITICAL REVIEW OF THE METHOD EMPLOYED OR DETERMINING HEATS OF COMBUSTION.

By STANLEY ROBSON, M.Sc. &c.

(*Concluded from p.* 585.)

SUMMARY.

the foregoing account, an endeavour has been made to de-
be and impartially review the work on the accurate determi-
ion of heats of combustion. The description has been of
essity lengthy. The following summary will, however, collect
more important points.

) *General Observations.*—(*a*) There is some doubt in every case concerning the degree of accuracy with which the temperature measurement was made. The mercury thermometer was used by all the experimenters ; and it is probable that Andrews and Favre and Silbermann did not apply corrections beyond that of the calibration of the bore of the thermometer, while it is doubtful if even Berthelot, Thomsen, and Stohmann fully realized the serious limitations of the mercurial thermometer which necessitates such exhaustive corrections, as are described by Guillaume* as necessary for accurate temperature observation with this instrument. The nature of the experiments may indeed be considered to limit the accuracy of the thermometer readings, in any case to within $\frac{1}{100}$th of a degree. In the experiments of Thomsen and Favre and Silbermann, a reading to this degree of accuracy would fall well within the allowable limits of error, in view of the range of temperature obtained. Some of Berthelot's experiments, however, only gave rise to a temperature increase of about 2°—in some experiments, indeed, a temperature increase of only 1½° was recorded. This is specially observable in the case of gases. The error due to thermometer reading in such cases would probably introduce an error of 0·5 per cent. into the value for the heat of combustion. This estimate can by no means be considered too large, as in such experiments the maximum temperature was reached in the short space of two minutes, which would necessarily entail a very great lag in the thermometer.

) There is also considerable doubt in many cases as to the purity of certain of the gases [notably methane and ethylene] employed by all investigators. Where particulars of the purification of the substances examined have been given in the original publication they have been reproduced in the account. From such data it is obvious that the gases more especially were not nearly so pure as those used in recent investigations on combustion by Bone, Dixon, Baker, and others, and a re-determination of the values for methane and ethylene is greatly needed. It is, however, unfortunate that full particulars are by no means always given. In such cases it is obviously difficult to assess the value of the data obtained.

2) *Special Observations.*—(*a*) The work of Andrews can only be considered of historical interest. The gases he employed were not very pure, his temperature measurement was not sufficiently accurate, nor was his experimental variation small enough to justify the adoption of any of his figures in preference to later work.

) The work of Favre and Silbermann was a careful scientific
estigation which even now deserves thoughtful consideration.
e results obtained, however, cannot be adopted in preference
those of Berthelot and Thomsen. The figures proposed by
m for the varieties of carbon have long been used as standard
ues, especially in technical work. Moreover, they received additional support when they were adopted by Thomsen, who did not make a determination himself. In spite of this, however, they are probably inferior to the corresponding value by Berthelot and Petit—in the first place, owing to the more or less crude ignition, and, secondly, owing to the incompleteness of the combustion. The values they arrived at for the heat of combustion of sulphur are, however, perhaps as accurate as any which have up to the present been obtained. The work they carried out with gases is by no means so good as that of Thomsen, especially when the admitted impurity of the gases they employed is borne in mind.

(*c*) The work of Julius Thomsen has long been considered a model of accurate experimental thermochemistry ; and the values that he obtained in the case of the permanent gases are probably the most accurate at our disposal. His work on volatile liquids, however, is more open to criticism, mainly in regard to the method of supplying the vapour of the substance to be examined at a constant temperature to the combustion vessel, which probably in some cases led to error. It is doubtful, even in Thomsen's work, if the gases he examined were comparable in purity to those employed in recent researches of a similar nature, especially since liquid air became a readily obtainable commodity.

(*d*) The work of Berthelot is essentially different from that which was carried out by his contemporary, Thomsen. When solids and liquids are concerned (except in the case of sulphur) the bomb calorimetric method is to be preferred to that employed by Favre and Silbermann, largely because complete combustion is assured. In the case of sulphur, the bomb calorimetric method is not really suitable, because this element does not quantitatively oxidize to the higher oxide.* Where gases are concerned, Berthelot's work cannot be said to be so accurate as that of Thomsen, because errors in temperature measurement become large in comparison to the temperature increment. Indeed, it may be said that before the bomb calorimetric method can be successfully applied to the combustion of gases, a much finer instrument than the mercury thermometer must be adopted for the temperature measurement. For this purpose, a platinum resistance thermometer might be employed.

(*e*) The work of Stohmann is a continuation of that of Berthelot ; but the care with which the values for benzene, and particularly naphthalene, were determined, and the small variations between his individual experiments is a sufficient justification for their adoption.

The following table summarizes the most important results obtained for substances likely to be of importance to a fuel chemist ; and such numbers as are marked with an asterisk are, in the author's opinion, the most reliable.

Heats of Combustion. Values which are Probably the Most Accurate.

Substance.	calories per gram.	B.Th.U. per lb.	B.Th.U. per Cubic Foot.	Investigator.
Charcoal	8,137·4	14,647	..	Berthelot
Sulphur	2,220·9	3,998	..	Favre and Silbermann
Carbon monoxide	2,427·1	..	341·1	Thomsen
Hydrogen	33,909	..	342·8	,,
Methane	13,219	..	1065	,,
Ethane	12,328	..	1880	,,
Ethylene	11,892	...	1673	,,
Acetylene	11,918	..	1557	,,
*Benzene	9,961·81	17,931	..	Stohmann
*Ethyl alcohol	7,080·4	12,744	..	Berthelot
*Carbon disulphide	3,392·4	6,106	..	Thomsen
Naphthalene	9,628·3	17,331	..	Stohmann
Cyanogen	4,990·4	..	1303	Thomsen
Hydrocyanic acid	5,870·5	..	7956	,,

* Liquid state.

Heats of Combustion.

Calories per gram-molecule or gram-atom. Experimental variation indicated after figures.

—		Berthelot.	Thomsen.	Stohmann.	Andrews.	Favre and Silbermann.
Carbon	Charcoal	97·649 ± ·284*	..	..	..	96·962 ± ·114
	Graphite	94·814 ± ·083*	..	..	..	93·509 ± ·315
	Diamond	94·319 ± ·052*	..	..	..	93·241 ±
Sulphur	Orthorhombic	69·30	71·080 ± 1·35	..	..	71·211 ± ·481
	Monoclinic	..	71·720 ± ·87*	..	..	..
	Plastic	..	..	..	..	72·427 ± ·141*
Carbon monoxide		68·2 ± 0·55	67·96 ± 0·29*	..	68·37	67·28
Hydrogen		68·95 ± 1·05	68·36 ± 0·12*	..	68·42 ± ·23	68·92
Methane		213·5 ± 1·25	211·93 ± 1·06*	..	210·8 ± 4·0	209·01
Ethane		372·3 ± 0·5	370·44 ± 2·13*	..	..	..
Ethylene		341·1 ± 1·05	333·35 ± 0·81*	..	335·43	332·00
Acetylene		315·7 ± 3·8	310·05 ± 1·71*	..	..	..
Benzene		776·0	791·87 ± 3·3	779·2 ± 1·01*	..	..
Alcohol (ethyl)		325·7 *	340·53 ± ·76 (vapour at 18° C.)	..	..	..
Carbon disulphide		253·3	258·30 ± 1·63*	..	..	258·11
Naphthalene		1241·6	..	1233·6 ± 2·3*	..	..
Cyanogen		262·5	259·6 ± 0·56*	..	..	..
Hydrocyanic acid		152·3	158·62 ± 0·43*	..	..	..

* Liquid state.

In conclusion, the author desires to thank Professor W. A. Bone for his help in drawing up the report, and Mr. R. S. G. Knight for his assistance in translating some of the original papers.

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* "Traité Pratique de la Thermométrie de Précision," par Ch. and Ed. Guillaume. Paris, 1889.

* H. Giran, "Comp. Rendu," 1904, Vol. 139, pp. 1219-21.

CITY AND GUILDS OF LONDON INSTITUTE.

The Work of Last Session.

THE effects of the war are clearly shown in the report of the work during the session 1914-15 of the Department of Technology of the City and Guilds of London Institute. The report (which is signed by Mr. Morton Latham, M.A., the Chairman of the Technology Committee), covers, of course, a period during the whole of which the war has been in progress; and it is remarked that the upheaval of the country generally is naturally reflected in the reduced numbers of students who were attending classes for technical training, and presenting themselves for examination at the end of their courses of instruction.

The technical training of large numbers of students has been suspended by reason of the fact that they have entered either the navy or the army; and, in addition to this, both the extreme activity in certain industries and districts and the slackness and dislocation of business in other trades, have been unfavourable to the steady attendance and training of young men in technical classes. This is amply sufficient explanation why, although the total number of classes registered in technological subjects remains practically the same, the number of students in attendance has fallen from 55,996 to 47,050 this year, which represents a reduction of nearly 16 per cent. on last year's figures. Following upon this, the number of candidates who have presented themselves for examination in technology from centres in the United Kingdom has fallen from 23,119 to 15,623, which is a decrease of some 32 per cent. While recognition is being made of the good work done under most difficult circumstances by the authorities and teachers, it is pointed out that towards the close of the session several technical schools rendered valuable help to the Ministry of Munitions by using their workshops for making those articles connected with munitions of war for which their machinery was best adapted, and by training men to take their place in engineering firms executing government contracts. In various instances hardship has been prevented by the excellent notice issued by the department at the beginning of the session, by which an undertaking was given by the Institute that no student should be prejudiced through non-fulfilment of the regulations in regard to attendances at registered classes, &c., owing to his having been engaged in military or civil work for the defence of the country.

It is remarked that the first examinations in "Gas-Fitting," for which 258 candidates entered, showed they have met the need which was felt for more systematic instruction in this increasingly important branch of the gas industry. The preliminary practical tests for Grade II. and for the Final examination were held at thirteen local centres. Acknowledgment is made of the fact that, in the conducting of these tests, the Institute has been greatly assisted by the cordial co-operation of the Institution of Gas Engineers, the District Gas Associations, and the local gas undertakings, "to all of whom, and especially to the Local Examiners, the thanks of the Institute are due." Particulars of both the practical tests and the written examinations were given in the "JOURNAL" for March 30 [p. 818] and May 4 [p. 290]; and the answers by candidates on the written papers were the subject of a detailed report by the Examiners (Mr. H. Kendrick, of Stretford, and Mr. R. Halkett, of Glasgow), which appeared on p. 427 of the issue for Nov. 23.

Appended to the report are the customary extracts from the reports of the Examiners upon the results of the examinations; and the remarks made by Mr. Samuel Glover, of St. Helens, in regard to "Gas Engineering," and by Mr. Walter Hole, of Leeds, as to "Gas Supply" [the questions for which examinations will be found in the numbers of the "JOURNAL" for April 27, p. 217, and May 4, p. 290], as well as some reference to the "Gas-Fitting" examination, will be found in another part of this issue [see p. 657]. In connection with the various extracts given—not, of course, specially relating to gas—the Committee emphasize a point which it is well should be borne in mind. It is that many expressions of praise of the work done are not included, so that criticism seems to be in somewhat undue proportion. The reason for this is that the main purpose of publishing these extracts is to show the directions in which the knowledge of the candidates is weak. As a matter of fact, with the idea of increasing the usefulness of their reports, the Examiners are expressly desired to point out any common defects, reasons for failures, and the way to remedy them. From the reports, conclusions of general application which may be drawn are that carelessness in reading the question is a common fault, that in many cases candidates show a tendency to become too discursive and prolix in their answers, and that lack of ability to perform correctly simple mathematical calculations is still too prevalent in a wide range of subjects.

Among those to whom thanks are accorded are the Council of the Institution of Gas Engineers, who act as an Advisory Committee on "Gas Engineering," "Gas Supply," and "Gas-Fitting." Thanks, it is said, are also specially due to the Society of British Gas Industries, for promising to provide next year prizes in the new subject of "Gas-Fitting" equal in amount to those already offered by them in "Gas Engineering" and "Gas Supply."

The proportion of candidates who have been successful in passing their examinations stands at 63·2 per cent. of those who presented themselves, which is practically the same figure as in 1914; and no marked divergencies appear in the more important subjects, even when the reductions in numbers exceed the average. At the different centres, there were 215 students in "Gas Engineering" (compared with 318 in 1914). Of these 167 presente themselves for examination, and there were 123 passes; the percentage of failures being 26·3. In "Gas Supply," there were 44 students (against 997); and of these 343 were examined, and 24 passed—leaving the percentage of failures at 27·7. There wer 482 students in "Gas-Fitting," of whom 258 presented themselve for examination, and there were 205 passes. In the Final examination in "Gas Engineering," 26 passed in the first class, 20 in th second, and 23 failed; while in the grade below the passes wer 38 and 39 respectively, and the failures 21. In the Final examination in "Gas Supply," 42 candidates passed in the first class 51 in the second, and 73 failed; while in the grade below th passes were 96 and 59, and the failures 22. In "Gas-Fitting," th figures were: Grade I., passes 104, failures 30; Grade II., passe 57, failures 19; and Final, passes 44, failures 4.

The programme for the session 1915-16 was issued in th summer, and noticed in the "JOURNAL" for Aug. 3, p. 235. Thi stated, among other things, that the syllabuses in "Coal Tar Distillation" and "Intermediate Products" have been revised.

THE GAS TURBINE.*

THE author's excuse for the issue of a book on the gas-turbine i that there were only two books printed in English on the subjec and these were considered incomplete because one had nothin to say about the Holzwarth type and the other dealt with littl else. No excuse was needed for Mr. Davey's contribution, sinc the gas-turbine merits discussion both in its theoretical and practical aspects, to which divisions he gives attention in Parts I and II. respectively of the book. It is inevitable that the forme should obtain the greater notice; but he nevertheless emphasize the opinion that the gas-turbine problem is now quite within th bounds of practical politics. By the latter suggestion the autho means, judging from the last chapter of the volume, that its feasibility simply awaits the mechanical development which will mak the machine economically successful. Opinions may differ, however, as to the extent to which such development can take plac The long list of patents given at the end of the book indicates tha much time and money have been spent on a problem which i alluring in view of the possibilities of an engine dispensing wit heavy reciprocating parts and foreshadowing reduced capita and working costs.

The trend of the author's remarks suggest that the difficultie due to the high temperature of combustion, the conditions of th working fluid, and the possible corrosion of nozzles and vanes ar not insurmountable; but he has not much to offer, in the sectio entitled "The Practice," to warrant hope at any rate for the mor immediate future. It is only necessary to turn to the concludin pages; and we find that Mr. Davey confesses that he can do n more than generalize about the gas-turbine and the part it i "likely to play among prime movers during the next few decades. His study of the subject, however, leads him to think that w have three possible forms of gas-turbines—viz., the constant-pressure turbine, single or mixed fluid; the constant-volume turbin with the closed combustion chamber, as in the Holzwarth type and, lastly, the open chamber or Karavodine turbine.

The first gives indication of the best fuel economy and the las the worst. The mixed fluid (steam and gas) constant-pressur turbines appear to be the most costly and cumbersome; but th author considers they have every advantage over the single-flui types; and, further, that they commend themselves for larg powers of 1000 H.P. and upwards. The Holzwarth turbines ar cheaper, and deemed more suited for units ranging from 100 down to 100 H.P., and where fuel economy is only of secondar consideration. The Karavodine type would serve for sma powers, since it is characterized by simplicity and lightness, although the fuel consumption is comparative high.

It should be borne in mind that these spheres are suggested b Mr. Davey's theoretical consideration of the question generall as is possibly his feeling that the chief field for the gas-turbin in view of its being essentially a high-speed machine, will lie in th production of electric energy, whether oil, blast-furnace, or producer gas be used as the fuel. The latter may be the case onc the efficiency of the gas-turbine approaches that of the large ga engine; but the prospect is still remote. The speculative character of Mr. Davey's final survey, following his theoretical discussion of the subject, is not surprising when it has to be stated tha "only two—or to be strictly accurate only three—gas-turbine have been actually built, made to operate successfully, and submitted to tests or to fuel consumption." Of these, it would seen no very cheering data had been obtained.

The author devotes his first six chapters to: (1) Genera Considerations of the Gas Turbine as a Heat Engine; (2) Th Contact-Pressure Single-Fluid Gas-Turbine; (3) The Mixe Fluid Turbines; (4) Mixed Fluid Turbines, Derived Types; (The "Explosion" Gas Turbine; (6) The Variation in Thermodynamic Constants and its Effect upon Efficiency. Obviousl the heat unit is an important and recurrent factor in all the ca culations made in these chapters; and the majority of reade will regret that the author has chosen throughout to use th hybrid unit "T.U.," the heat required to raise 1 lb. of water 1°

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* The Gas-Turbine. By Norman Davey. London: Constable and Co Limited. [Price 15s. net.]

us, 1 lb. of combustion mixture of Mond gas and air is de- ibed as giving 550 T.U., and Glasgow coal gas as having a rmal value of 11,500 T.U. per pound. Yet, when quoting the lzwarth data and Humphrey pump experiments, the figures respectively in calories and British thermal units.

;as-turbines working with a single fluid and taking in heat under istant pressure are broadly divided into two classes—those in ich a quantity of air (or other gas) is raised in temperature ts passage through a number of tubes heated by the external nbustion of fuel, and those in which the fuel employed is ned with its requisite amount of air or oxygen and the pro- ts of combustion expanded through the turbines. The author, liscussing both types, dismisses the first as having theoretical erest only, but considers the second as practicable under cer- conditions. His faith is more strongly placed in the future he mixed fluid turbine where the working fluid consists of a ture of the products of combustion from gas (or oil) and air, ether with steam. "The experimental turbine of Armengand Lemale worked (or failed to work) on this plan." The mixed d types, he says, appear to give a better chance of economy nparable with other prime movers. A reservation is, however, de with respect to the gas "explosion" turbine, which is cribed as the "dark horse" of gas-turbine research.

:hapter III., the longest in the book, deals with the mixed fluid es. The author says he has been engaged in considering the cticability of this class of turbine; and although it is with dence that in the book he "prefixes his name to the steam- -air turbine" (for which he took out patents in 1907), he is not re that the matter had previously been subjected to any definite investigation. It is stated that the practicability of steam-and-gas turbine" rests in three main issues: (1) Fuel sumption and cost, (2) initial cost, (3) reliability and dura- y expressed in maintenance charges. The first depends on temperature the turbine blades will stand, the peripheral city possible, and the thermodynamic efficiencies of the tur- and the pump. The capital and maintenance charges are erned by the temperatures, by the pressures, by the peripheral eds employed, and by the expansion ratio referred to the size he pump. The last two issues work in opposition to the first, to strike an advantageous balance is the problem which offers f for analysis in gas-turbine research. To this the author otes himself, through the remaining pages of the chapter by ulations and diagrams of his design of a 1000 B.H.P. mixed l turbine. But as far as can be gathered, the Davey turbine still, if constructed, to be subjected to practical test.

Chapter V., Mr. Davey has under theoretical consideration "explosion" gas-turbines, in which class come the Holzwarth Karavodine types. He states that these turbines present the test difficulty to analysis, and involve a number of assump- s that only actual experiment can adequately support; but evident conclusion is that their over-all efficiency is not likely each that of the steam and gas-turbines with the same initial peratures.

ne turns with expectation to the second part of the book lled "The Practice," and is met with some disappointment. pter VII. deals with "accessory machinery"—such as the pro- er and furnace; the turbine wheel and water cooling; the re- erator and condenser; governing devices; the pump. The ior's remarks refer, however, principally to the purpose and derata rather than the constructional and mechanical details hese parts. It is true that the author has little else to draw but the Armengand-Lemale, the Holzwarth, and the Kara- ne turbine plants; but seeing he had already indicated the ts of these, the title of "Practice" is not altogether justified this half of the book. The section is, however, in itself inte- ing. Enough is said, for instance, to suggest the construc- al difficulties likely to be found in overcoming heat losses, voiding the troubles due to high temperatures to secure easy erning, and to obtain adequate compression.

he erosive effect of high temperatures, particularly on the es, is referred to. Mr. Davey says that the temperature ughout the turbine being the same as that on the blades, it be necessary to water-jacket the turbine casing, and, in the of the mixed fluid type, without very much loss of heat. In ral parts of the book Mr. Davey combats the suggestion made Ir. R. M. Neilson, that the turbine blades could only (without r cooling) stand a temperature of 700° C., and assumes that uld be "possible to use a temperature of 500° C. on blades ially composed of some resistant alloy." In the case of water ing, 700° C. is given; but beyond these figures he does not go.

success of the constant pressure gas-turbine as an economical engine depends very largely on the pump or compressor; and author devotes some pages to discussion and illustration of matter.

he concluding chapters deal with the history of, and experi- tal work done in, gas-turbine work. The particulars and trations given in Chapter XI. of the Armengand-Lemale B.H.P. single fluid constant pressure, of the Holzwarth 1000 P. closed chamber constant volume, and of the Karavodine B.H.P. open chamber explosion turbines are worth notice.

enerally speaking, the book could do with some revision to d repetition of points dealt with in different parts of it. There tendency to use varying terms to signify the same thing, as, nstance: Furnace and combustion chamber; steam-and-air steam-and-gas turbines; &c. An example of the latter is to oted above, in the remarks on mixed fluid types of turbines,

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INCREASED TOLUENE PRODUCTION.

By Burton Dunglinson.

The primary object of a coke-oven manager is to produce a good marketable metallurgical coke, with a maximum yield of bye-products ranking as of secondary importance. As a rule, he is content to operate his plant under fixed conditions, depending on the skill of his foremen for a large output of coke; while the chemist maintains the steady working of the bye-product plant, by his routine tests, which are very valuable as far as control is concerned, but tend to make the whole scientific aspect a drudge.

The yield of benzol is dependent on the viscosity and the temperature of the "stripping" oil with low gas temperatures and an efficient distillation plant. Though the analysis of the oil before and after distillation helps to control work, I have no hesitation in saying that the average coke-oven manager places more faith in his daily yield of crude benzol; and the question is raised "Why should he?" In the first place, there is no quick and accurate method for ascertaining the exact amount of aromatics in a gas, and he has to rely on the absorbing efficiency of his scrubbing oil, without knowledge of the amount of benzol passing his scrubbers, other than the comparative luminosity of a flame; and even this may be influenced by the entrained creosote oil. The nitrobenzene method for benzol estimation is unstable; while *paraffinum liquidum* as an absorbent for aromatics is not reliable. With all the chemical skill at our command, a true determination of small quantities of aromatics in a gas is a very difficult matter; and those who lay claim to an increase of toluene by the use of steam or lime when coking coal, must prove that the yield was not due to outside influence affecting the retort, as even a difference of 10° C. alters the constitution of a body undergoing "cracking."

Determination of Aromatics in Coal Gas.

I might here offer a suggestion for the determination of aromatics in coal gas. It is not generally known that a substance which has been recrystallized from benzene or toluene, if placed in a desiccator while still wet, alongside a piece of naphthalene, gives a dry crystal after an hour or so, due to the absorption of the solvent by the naphthalene. A direct determination could not be carried out by simply passing the gas over naphthalene in a tube, as the substance is so volatile; but I venture to suggest that, if the gas was washed free from olefines and moisture, and passed over well-cooled naphthalene with a paraffin catch-bottle following, more reliable figures could be obtained, though comparative results are provided by using the fresh scrubbing oil as a solvent in laboratory tests. Even this test leaves a lot to the imagination, as it follows the lines of a crude benzol test—being distilled in a retort with the thermometer in the liquid in order to find the yield of light hydrocarbons. These tests are of no value whatever to the chemist, but no doubt assist in controlling the benzol plant.

If we follow the benzol to the refinery, we find the "Engler" distillation test in use, which gives a clearer idea as to the chemical constitution of the products and the alteration of composition by observing the boiling-points and concentration of distillate round a definite temperature. If all these tests relating to toluene production were conducted on a purely scientific basis, a clearer idea of the changes tending to increase or decrease the yield of aromatic hydrocarbons would be forthcoming, and consequently a better working of the bye-product plant generally. When we consider the number of processes and patents advanced to increase the yield of bye-products from the destructive distillation of coal, we ask ourselves: "Are practical results going to substantiate the theoretical calculations involved?"

Methods of Increasing Toluene Yields.

Referring to the many methods of increasing toluene yields, the admission of steam through the heated charge, and the admixture of lime or limestone with the coal, has a great number of adherents; and these processes will no doubt find their value where plant can be modified to suit them. The passing of steam through a charge of heated coal in an oven, tends to promote dissociation and different recombination of the hydrogen and oxygen. But the greatest effect is derived from its cooling properties, which provide a lower temperature of distillation and less "cracking" of the aromatics already formed, and thereby an increase in the yield of toluene.

Effect of Liming Coal.

A few years ago, I was intimately connected with experiments to find the effect of liming coal, and from results obtained can safely say the increased quantity of bye-products was negligible, and their value was counteracted by the increased ash and sulphur content of the coke. This must be considered where coke is sold by analysis, and the quality of coal being fed to the ovens allows very narrow limits for an increase in ash content. Undoubtedly, the limestone or lime combines with the organic sulphur compounds evolved, to yield calcium sulphide; and therefore the added lime is not going to facilitate the formation of a blast-furnace slag, as it is already combined with an impurity which the iron-works manager tries to eliminate.

Claim has been made that the addition of lime tends to harden the coke; and perhaps a few figures relating to the increased (?) hardness may be helpful. The lime used was added in the form of limestone, finely ground, and mixed with the coal at the disintegrator. From a calculation made, on the analysis of the ash, sufficient limestone was added (about 2 per cent. by weight of the charge), assuming that it combined with the ash, to form a monosilicate of the type commonly met with in blast-furnace practice. But I cannot entertain the idea that a fusible slag is formed in the oven, as the finely-divided surface carbon would prevent intimacy between the lime and ash.

This is substantiated by treating finely powdered coke with C.O.V. at high temperatures, for oxidation purposes, in the Kjeldahl nitrogen test. The reaction takes place very slowly, and sometimes requires the addition of a little mercury sulphate to start it; the lag being attributed to the surface carbon protecting the more easily decomposed bodies. In the experiments, the charge was fed to the ovens in the form of a compressed cake; and no difference was made in the heat treatment usually accorded the coal. The resulting coke was pitted with lime particles, and contained quite as much breeze as an ordinary charge. The sulphur content had increased by 0·1 to 0·2 per cent., and the ash from 0·5 to 1 per cent. higher. The crushing strength of the dry coke was estimated and compared with a sample from a charge without lime. Three samples were taken from each oven; and the results averaged—

	Crushing Strength.
Ordinary charge	1400 lbs. per sq. in.
Limed charge	1420 ,, ,,

the slight increase in the limed charge being well within the factor of error. Strange to say, the ascension-pipes were much freer of carbon during the tests; but this may be due to the increased carbonic acid content having an oxidizing action on the hot carbon of the pipes.

Experiments on Yield of Benzene and Homologues.

Experiments have been proposed to ascertain, for particular kinds of coal, the minimum temperature at which it will yield the maximum quantity of benzene and homologues, without forming paraffins. This would be a lower temperature than in ordinary gas-making; and only 7000 to 8000 cubic feet of gas would be obtained from a ton of coal. Before charging into the retort or oven, the coal was to be well moistened with spent ammoniacal liquor, so that the temperature of the oven was lowered, and more ammonia obtained. The gas is treated in the usual manner for ammonia extraction; and for benzol recovery it is passed at as low a temperature as possible through a hydrocarbon oil boiling at a high temperature. The crude benzol is recovered by distillation; and the yield is about 6 gallons from a ton of dry coal—the coking temperature being about 700° C.

Question of Temperature.

At the present time, toluene and benzene are necessary for the manufacture of our high explosives; and it behoves the gas and coke works manager to recover every gallon possible. With the existing conditions of coking, he is actually destroying his aromatics in working at a high temperature, forming free carbon and hydrogen. Why cannot our coking conditions be modified to produce more bye-products and waste less energy in heating the charge to such a high temperature? With high moistures a marked decrease in benzol content takes place; and as a longer time is necessary to evaporate the added water, a consequent big reduction in temperature is the result, with less "cracking" of the paraffins formed in the earlier coking stage. Therefore a low moisture content, consistent with easy charging, is the first step toward better yields of benzol. All paraffins require a critical temperature for maximum conversion into aromatics; and as paraffins are primarily formed in the first stages of coking, it follows that a sufficiently high temperature must be maintained for total conversion. This temperature is always exceeded in a coke-oven or gas-retort, with the result that a secondary decomposition of the light aromatics forms naphthalene, hydrocarbon gases, hydrogen, and carbon.

A ton of coal yields at high temperatures (1100° to 1200° C.) approximately 0·3 gallon of toluene and 12,000 cubic feet of gas of low candle and calorific power; while a ton of coal distilled at low temperatures (900° to 1000° C.) yields 0·98 gallon of toluene and about 10,000 cubic feet of gas of higher calorific and candle power. But the coke still contains about 8 per cent. of volatile matter. The crushing strength of the coke is not lowered appreciably, and should not cause "hanging" in the blast furnace while the ash content is decreased, and no doubt the coke woul be more combustible than ordinary coke, and supply the iron works possessing a recovery plant with a tar containing a larg proportion of cresols, which will shortly have a fair demand fo conversion into phenol.

If a lower coking temperature were adopted, the yield of ammonia would be much greater; and as the critical temperatur for aromatic conversion is 700° to 800° C., these bodies would b produced in nearly maximum quantity. Faraday first discovere benzene in the liquid condensed by pressure from Pintsch oil gas and this liquid contained a higher proportion of xylenes tha toluene, and more toluene than benzene. The temperature o "cracking" was about 700° C.; and the diminishing percentag of light aromatics must be due to the greater vapour pressure an greater susceptibility to further decomposition.

At the present time, the demand for toluene and benzene ha increased enormously; the former being used for the manufactur of T.N.T., and the latter for synthetic phenol; and the attemp to capture the dye industry will cause the demand to be excessiv for the next few years. These facts should be considered by th gas and coke-oven manager, and every available means be take to increase their output of benzol and toluol; while the blast furnace manager should remove his prejudice against a coke containing a slightly higher percentage of volatile matter, and cooperate with all concerned to provide a quick and happy issue t the war.

COKE PRODUCTION IN THE UNITED STATES.

The current issue of the "Journal of the Society of Chemica Industry" contains an abstract of a paper on this subject published by the United States Geological Survey.

It points out that the production of coke in the United State in 1914 amounted to 34,555,914 short tons, valued at £17,667,00 compared with 46,299,530 short tons, valued at £25,785,000, i 1913. Of the coke made during 1914, 23,335,971 tons was beehive coke, valued at £10,051,000, and 11,219,943 tons, valued a £7,616,000, was bye-product coke. The decrease in the production of retort coke in 1914 was 1,494,757 short tons, or 11·8 pe cent.; the beehive output decreased 10,248,859 tons, or 30·5 pe cent. With the exception of two years, 1908 and 1914, the production of bye-product coke has increased each year since the firs ovens were completed in 1893. The percentage of bye-produc coke to the total in 1901 was 5·4; in 1910, 17·1; in 1912, 25·3; i 1913, 27·5; in 1914, 32·5.

In 1913 there was a net increase of 420 in the total number c ovens, although 2833 ovens (all of the beehive type) were abandoned during that year. There were 779 ovens constructe during the year, of which 192 were retort-ovens and 587 of beehive type. The total number of ovens of all kinds in operation i the United States decreased in 1914 from 102,650 to 99,755— net loss of 2895. In addition to the number of ovens abandone during 1914, there were 45,117 idle, of which 667 were retorts an 44,450 were beehive ovens. The new ovens in course of construction at the close of 1914 numbered 1249, of which 644 were retort and 605 were beehive ovens.

The first ovens of the retort type constructed in the Unite States comprised a plant of twelve Semet-Solvay ovens, wit recovery apparatus, at Syracuse, built in 1893, primarily for th recovery of bye-products for use in connection with the chemica works of the Solvay Process Company. These ovens had charging capacity of 4·4 tons of coal; and the time required fo coking was 74 hours. The present-day bye-product ovens hav capacities ranging from 10 to 16 tons of coal, and make furnac coke in sixteen to eighteen hours. These developments hav been accompanied by marked improvements in bye-product recovery, and in the manufacture of ammonia. Still anothe marked development in bye-product oven practice is in the adaptation of the surplus gas to the illumination of cities and towns In the earlier days, the ovens produced only a small and irregula quantity of surplus gas, which was also irregular in quality. To day bye-product ovens in the United States are selling ove 50 million cubic feet of gas a day for domestic purposes. Almos the entire supply of gas in some cities is from retort-ovens.

The total value of the coke, gas, tar, ammonia, and other products produced at bye-product recovery ovens during the last tw years is shown in the following table:

Product.		1913.		1914.	
		Quantity.	Value.	Quantity.	Value.
Gas	million cubic feet	64,553,941	$5,694,691	61,364,375	$6,009,583
Tar	American gallons	115,145,025	2,830,158	109,901,315	2,867,274
Ammonia, sulphate (or reduced to equivalent in sulphate)	pounds	173,342,349	5,324,444	170,763,906	4,696,590
Ammoniacal liquor	American gallons	4,102,448	537,413	5,938,233	658,497
Anhydrous ammonia	pounds	*28,663,936	*2,135,656	*25,370,509	*2,300,137
Other bye-products		..	403,579	..	†997,007
Total value of bye-products		..	$16,925,941	..	$17,529,088
Coke	short tons	12,714,700	48,637,852	11,219,943	38,080,167
Grand total		..	$65,563,793	..	$55,609,255

* Mainly ammoniacal liquor sold on pound basis of NH_3. † Mainly benzol.

COKE-OVEN MANAGERS' ASSOCIATION.

Meeting at Sheffield.

The members of the Association, meeting in the Hall of Applied ience, Sheffield, on Saturday evening, under the Presidency of r. George Crisp, had before them a paper upon "Benzol." iere was a large gathering present.

The President, prior to introducing the author of the paper, nounced a notice of motion by Mr. B. W. Haigh (the Hon. easurer) that Rules 4 and 5 be so altered as to provide for embership of the Association being divided into four classes—embers, associate members, associates, and honorary members; third class (associates) being a proposed new feature, which uld enable the Society to admit certain useful people connected th the industry who could not be admitted under the present nstitution. The President added that Rule 4 had given the uncil considerable trouble; and they would like full authority m the general membership before taking any action. There s a movement in favour of the class of honorary members being ot very close and reserved; and for directors of works, and nilar gentlemen, there should be room for admittance as assocites. It was his pleasant duty to announce that the memberp was increasing, and that there were several gentlemen iting for admission if (and when) the revised Rule 4 were opted. It seemed absolutely certain that the Association had nost successful and useful future before it. The Council had eady arranged for the first annual dinner to take place on . 15, at the Grand Hotel, Sheffield. They had with them t evening Mr. George Taylor, who would give them a paper "Benzol." The Council had thought that, owing to the portance of the subject at the present time, the first of the ucational papers proposed to be delivered to the Association uld be on this matter. People who were not intimately conted with the industry scarcely realized how highly important vas for the country to have benzol to-day; and the Council that anything they could do in the way of publicity, or of help- any members who might be in difficulty with their plant, would of great usefulness. It had been said that if the coke-ovens he Central Empires were destroyed, the war would not last a nth. He was afraid they could not do so much; but they ld, at any rate, see to it that this country's own plants were rked on the most satisfactory lines, and if by educational ers they could produce a few more gallons of benzol, they ld be doing a great service to the country. Mr. Taylor, as bably most of them knew, was an experienced hand in regard enzol. He had been with it from his youth upwards, and had de a great study of it. What he did not know about benzol s hardly worth knowing.

Ir. George Taylor, of the Silverwood Collieries, then read following paper on

BENZOL.

One of the most important matters at present before the carizing world is the recovery and rectification of benzene and homologues from the gases evolved in the destructive distilla- of coal. Before the general adoption of coal gas as an illuant, a certain amount of gas was manufactured from oil and vered to consumers in cylinders, under pressure, in a similar ion to oxygen at the present time. Benzene was discovered Faraday in 1825, in the liquid condensed by cooling this oil in freezing mixture. In 1833, Mitscherlich prepared benzene n calcium benzoate, nitrified it, and recorded the characters of nitro-benzene (1834).

t was not until the year 1845 that the presence of benzene was erved in coal tar and identified by conversion to nitro-benzene A. W. Hofmann. Charles Mansfield, who really originated the hods for rectification of benzene, and utilized for the purpose still then employed for the production of alcohol, lost his life 854, when preparing benzene for the Paris Exhibition. So far zene had been manufactured for the purpose of carburetting . Then came the discovery of aniline dyes—Perkin in 1856, Hofmann in 1859—which gave the needed impetus to the intry; and since that time progress has steadily been made.

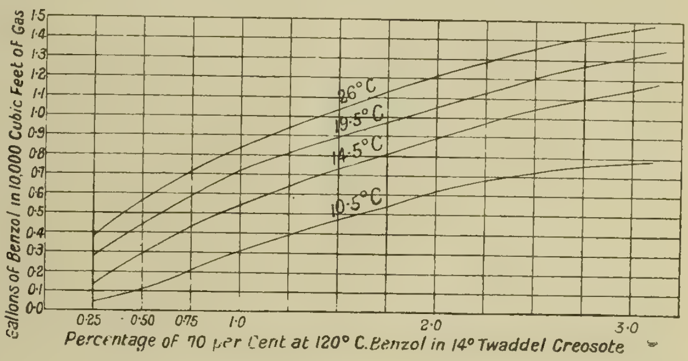
Benzene Formation.

nowledge of the formation of benzene in gas is not very conive. It has been found that in distilling coal at low temperas paraffins result; and that on increasing these temperatures iminution in the amount of paraffins takes place, along with production of benzols, until at 650° C. the condensable rocarbons are almost exclusively those of the benzene series. coke-oven gas the volume due to the presence of benzol as our ranges from about 0·8 to 1·6 per cent. of the total, which responds to 2 to 4 gallons of benzol per ton of coal distilled. removal of the benzol is, of course, attended by a corrending diminution in the volume of the gas, a falling off in rific value of from 32 to 64 B.Th.U. per cubic foot gross, and nsiderable loss in illuminating power. In order that little of benzol shall be removed in tar extraction, it is necessary that process be carried out at a temperature of not less than C.; the gas being suitably cooled for ammonia scrubbing afterds. In the case of direct processes, where the tar fog is extracted from hot gas, there is no risk of benzol being removed with the tar. Before entering the benzol scrubbers the gas should be freed from water by a trap.

Absorption of Benzol.

Presuming then that the gas is freed from ammonia, tar, and mechanically carried moisture, and that its temperature is below 25° C., the next problem is the absorption of the benzol as completely as possible. Two absorbing mediums are in general use—coal-tar creosote and blast-furnace oil. The methods of using these oils being different, it is necessary that they should not be mixed. Considering that the ultimate aim of the process is the production of pure benzene, &c., it is advisable to use oils that contain the smallest possible amounts of matters not helpful to absorption. Such are phenols, phenoloids, basic compounds, naphthalene, and tarry substances. If present, these impurities should be removed from the oil before its use as an absorbent, as by this procedure the life of the oil is prolonged and the loss in washing the recovered benzols is much reduced; also, the water separates more easily from the oil in the storage tanks.

With regard to the plant necessary for oil washing, tower scrubbers of about the same capacity as those used for ammonia extraction are usual, and oil is circulated through them in a similar manner to that in which liquor is circulated in ammonia scrubbers. There is, however, a growing tendency to adopt rotary scrubbers, usually of the brush type. These scrubbers are highly efficient, and, by reason of the more intimate contact of oil with the gas, a higher percentage absorption is obtained than is the case with tower scrubbers; also the plant can be arranged so that the power expended in circulating the oil is less. Another advantage is economy of ground space. A rotary scrubber of 8 feet internal diameter, with eight to ten washing chambers, is capable of dealing with the gas from 200 tons of coal a day.



The accompanying chart gives curves showing the amounts of 70 per cent. benzol vapour in gas which is in equilibrium with benzolized creosote of 14° Twaddel at various temperatures. These vapour pressure determinations were obtained by the increase in volume method, and consequently may give rather high pressures for the percentages of benzol in the oil used. Nevertheless, they show that the rich oil in most of the plants is far from being saturated, and that the effect of temperature on the return gas is very considerable.

According to the quantity of coal carbonized, the circulating stock should be from 40 to 80 tons, and the fresh oil required to make good losses runs from 20 to 35 gallons per 100 gallons of benzol made—unless it is found to be salty, when somewhat more will be used.

Provision should be made for the separation of water from the circulating oil, as watery oil is one of the principal causes of benzol loss. This is, of course, general knowledge; but it is surprising to find on how few plants arrangements are made for dealing efficiently with water.

Distillation Methods.

The benzol is driven off the benzolized or rich oil by distillation. Formerly this was accomplished in a manner similar to tar distillation. Now the whole of the benzol is produced by the continuous system; the rich oil circulates through a cap and plate still, meeting a current of steam which drives off the benzol—the spent oil, after cooling, being recirculated through the scrubbers.

Many types of distilling plant are in use with more or less success. It is generally admitted that, for economy, an exchange of heat should take place between the incoming rich oil and the hot debenzolized oil from the still. In some cases the rich oil is heated further by steam-heaters. This is particularly the case where the still is being worked up to its full capacity, and space cannot be afforded to allow the dephlegmatory action of a colder oil. The stills themselves fall into two classes—one in which powerful steam-heaters are placed in a chamber at the base of the still, with the intention of drying the effluent oil, and the other which works with wet steam only. In the latter type provision should be made for separating the water from the oil while still hot. Vapours of water and benzol leave the still at about 100° to 112° C.; and they must be partially condensed or dephlegmated in order that a 65 per cent. benzol may be obtained. The fraction which condenses at a temperature of less than 95° C. is the required material. The heavier matters consist of water, naphthalene, light oil, and phenols, and are usually small in quantity. In connection with the condensing of the benzol, it is highly important that no back-pressure should be thrown in this process. If this is not the case, difficulty will be experienced in denuding the oil of benzol, and losses will occur. The following are working data obtained from plants in various parts of the country:

	A	B	C	D	E	F	G
Benzol in 10,000 cubic feet of unscrubbed gas	2·5 to 2·7 galls.	2·5	2·32	3·0	3·3	2·52	3·0
Benzol in return gas	0·4 to 0·75 ,,	0·5	0·07	0·09 to 0·15	0·5 to 0·15	0·60	0·25 to 0·40
Benzol in rich oil	3·6 p.c.	2·5 p.c.	4·5 p.c.	4·5 p.c.	3·5 p.c.	3·1 p.c.	2·75 p.c.
Benzol in debenzolized oil from still	0·6 ,,	3·0 ,,	0·2 to 0·3 p.c.	0·8 to 1·2 p.c.	0·5 ,,	0·9 ,,	0·25 to 0·9 p.c.
Temperature of oil passing to still	?	?	108° C.	120° C.	85° C.	?	15·25° C.
Temperature of oil issuing from still	110° C.	105° C.	112° C.	9·5° C.	105° C.	?	104° C.

It can be seen from these figures that a high saturation of oil, where consistent with a good return for gas, is to be desired; also, the oil should certainly be heated to 110° C. in the still. Should this not be the case, and the effluent oil contains over 0·5 per cent. of benzol, the steam supply should be superheated. From information to hand concerning two plants, the introduction of superheated steam increased the yields of benzol about 5 per cent.

Purification and Fractionation.

In order that coke-oven benzol may be of use in the arts, it must be subjected to a purifying process and separated more or less completely into its constituents—the last to conform with commercial specifications. The chief impurities to be removed are:

Carbon bisulphide	CS_2	Pyridine	C_5H_5N
Thiophene	C_4H_4S	Aniline	$C_6H_5NH_2$
Thiotoluene	C_5H_6S	Naphthalene	$C_{10}H_8$
Paraffins	$C_nH_{(2n+2)}$	Creosote oil and resinous matters (such as cumarone, indene, &c.).	
Phenols	$C_nH_{(2n-)7}OH$		

The customary procedure for the removal of impurities is to wash with 168° Twaddel sulphuric acid, then with water; acids are then washed out with 20° Twaddel caustic soda solution, and the benzol rewashed with water. This washing may take place on the benzol as recovered, or the naphthalene and creosote may be separated by a primary distillation with wet steam, known as "blowing over," and the purer distillate washed as above. A further alternative is to separate into crude fractions, which are washed when sufficient of any one is obtained. The last method presents numerous advantages, among which are economy of acid, smaller washing losses, and a reduction of the work to be performed by the rectifying still. Since it is probable that, in future, commercial pure products will be in greater demand than formerly, this advantage should be considered.

The plant necessary for washing is a special-shaped vessel of boiler-plate, usually lined with lead, of from 2000 to 3000 gallons capacity, and provided with mechanical means by which the benzol can be thoroughly agitated with the washing material. Basic impurities are easily removed by acid washing; but if it is necessary to remove thiophene also, the acid washing must be repeated and prolonged until the laboratory sample gives a negative result by the isatin test. In any case, the completion of the washing should be ascertained by distilling a sample from the washer and treating the distillate corresponding to 90 per cent. benzol with 10 per cent. of pure sulphuric acid. A well-washed benzol will not colour the acid darker than N/10 potassium bichromate solution.

The acid washing is followed by a water washing. Here care must be taken to avoid a violent agitation, but the water should rather be used to rinse the sides of the washer, as some benzols have a tendency to emulsify with water, and cause large washing loss. The acid washings treated with water separate into solid resinous matter and an acid liquor, from which pyridine may be separated by treatment with ammonia liquor, and the resulting sulphate solution used in the sulphate-house. The benzol is then washed with an excess of 20° Twaddel caustic soda solution, which removes the traces of sulphuric and sulphurous acids and any phenols that are present. The caustic solution may be used until spent. The quantity of acid employed is generally about 6 to 10 per cent. of the weight of benzol; and washing losses may be from 6 to 16 per cent. on the same.

The still employed for "blowing over" the benzol is of 3000 to 4000 gallons capacity, has twelve to fifteen trays in the fractionating column, and is provided with direct and indirect steam heating. The charge is considered as worked off when the distillate boils at 200° C., or when naphthalene becomes evident. The once-run benzol must then be separated into commercial fractions by distillation in a rectifying still. Many types of these have been erected; the following being the essential features: The body of the still should be made of the short horizontal, cylindrical shape, and heat be supplied by a large number of steam-pipes running through the still and a wet steam coil. The fractionating column should be of ample capacity; the two main varieties now at work being the cap and plate introduced into benzol distillation by Heckmann, and the perforated plate originally adopted in the Coffey still. Differences in detail are found in the size and shape of the caps, depth of seal, position and shape of overflow, also in the number and size of holes in the perforated plate. It is worth noting here that while newcomers in this field erect complicated plant, with cap and plate rectifying columns, benzol distillers of old standing show a preference for simple plant and perforated plate column. As a number of stills of the latter kind are successfully producing pure benzene and toluene, it would appear that the opinion prevailing in some quarters, that only the cap and plate column will produce a pure product, is scarcely correct.

There are also two main types of analyzer—one being a cylindrical vessel about half the size of the fractionating column, filled with copper balls or other condensing material, and the other the well-known multitubular condenser supplied with a water feed, the benzol vapours passing around the tubes. Differences are also found in the point at which the analyzer discharges its condensate into the fractionating column. The cooler is usually of the worm type. The varieties of apparatus for separating the benzol and water all work on the principle of syphoning the water from beneath the benzene, which overflows directly and is controlled by the height of the syphon.

Chief Products of Distillation.

The chief products obtained by the distillation of benzol are shown in the following table:

Commercial Name.	Per Cent. of Pure				Specific Gravity 15½ C.	Range of Distillation at Barometric Pressure 760 mm.
	Benzene.	Toluene.	Xylene.	Cumene.		
90 per cent. benzol	84	13	3	—	·880	90 per cent. between 81 and 100° C.
50 per cent. benzol	43	46	11	—	·875	90 p. ct. between 89 and 120°; 50 p. ct. at 100° C
Commercial toluol	15	75	10	—	·870	90 per cent. between 107 and 120° C.
Solvent naphtha	—	5	70	25	·875	90 per cent. between 135 and 160° C.
Heavy solvent naphtha	—	—	5	80	·920	90 per cent. at 190° C.
Benzol for pure benzene	95	5	—	—	—	90 per cent. at 90° C.

A coke-oven benzol with retort test (specific gravity ·887)

100° C.	51 per cent.
120° C.	72½ ,,
160° C.	82½ ,,
180° C.	87½ ,,

gave on primary distillation in laboratory without washing:

100° C.	70·6 crude 90's
100° to 120° C.	10·0 ,, 50's
120° ,, 160° C.	7·6 ,, solvent naphtha
160° ,, 200° C.	6·3 ,, heavy ,,
Residue	4·6 creosote oil, &c.
Loss on distillation	0·9

Further fractionation gave the following results after washing:

		Specific Gravity.
Washing losses	8·2	—
Distillation	2·8	—
CS_2 fraction	2·0	·890
Pure benzene	54·0	·884
,, toluene	11·8	·872
Solvent naphtha	11·4	·875
Heavy ,,	5·0	·930
Creosote oil	4·8	—

Works distillation of a similar benzol gave—

64·0	90 per cent. benzol
6·5	,, toluol
7·5	solvent naphtha
5·0	heavy ,,

Loss (washing, creosote, &c.) being 15 per cent.

The points at which the distillates should be changed into different receivers may be ascertained in two ways. The approximate quantities of each distillate are usually known. If, therefore, the tank into which the distillate is running gives the correct distillation test, the receiver should be changed. This necessitates the constant attendance of someone able to make and interpret the tests. Alternatively, a litre sample may be fractionated in the laboratory; and the results being compared with the works results, it is possible to forecast the yields from future distillations with a fair degree of accuracy. In working for pure products special cuts are made, and the progress of distillation must be carefully watched, since towards the end of distillation changes take place with rapidity.

It is perhaps needless to remark on the great risks of explosion d fire in the distillation house; but it is interesting to note that r in contact with benzene at ordinary temperature contains over per cent. of benzene vapour at the surface of contact; and as e explosive range of benzene vapour in air has been found to lie tween 2·6 and 6·5 per cent., it is evident that precautions against plosion cannot be too complete.

THE FUTURE.

As to how far coke-oven owners should extend their activities chemical manufacture is a matter of opinion. Tar distillation d the production of intermediate compounds—among which nzol derivatives occupy a highly important place—have been ofitable industries in the past. Still, little of the profit has been voted to the extension of existing processes, and less to the acuisition of the technical knowledge necessary for an incursion to the fine organic chemical and colouring matter industry, now iefly in the hands of alien enemies. If, then, the manufacture intermediate compounds becomes a branch of the coking instry, the present producers will be compelled to turn their atten on to processes which really require technical skill and scientific rection, so reviving what was until recently a moribund industry, d thereby justifying coke-oven enterprise.

DISCUSSION.

The PRESIDENT said the paper had, it seemed to him, opened up subject for deep thinking and reading at leisure, when there was ne to carefully study it.

Mr. STANLEY COOPER congratulated Mr. Taylor on the manner which he had dealt with his subject, which was one that was pable of a great deal of widening. It was an industry which as open to considerable improvement. The figures put before em by Mr. Taylor showed very clearly that there was room for provement in the working of the majority of benzol plants in e country. There were a few points on which he would like, if ssible, further information, and one or two on which he did t entirely agree with Mr. Taylor. In the third paragraph of the per the author had referred to the loss of calorific value and duction of illuminating power resulting on the removal of the nzol. This was a point of very particular interest to him (the eaker), as one who was concerned in public lighting. Had Mr. aylor any absolute data as to how far the carbonating influence the creosote oil compensated for the loss of the benzol? On vestigation, it would be found that the theoretical loss did not ree with the practical loss. The question of the use of rotary rubbers or tar-scrubbers was always an interesting point. It as said by the lecturer that they gave an advantage in ground ace; but he (Mr. Cooper) did not think there was much gain this respect, because, after all, a tar-scrubber did not occupy uch space, and, as a matter of fact, ground space of a few uare yards on a coke-oven plant was usually not of very mateal importance. In regard to the use of superheated steam, he ould like to know what steam pressure they should go to without tting the superheated steam. The usual working pressure was o lbs., taking an average. Did the author consider that, if this ere obtained, it was necessary to superheat beyond it. He (Mr. ooper) thought in one or two instances Mr. Taylor suggested rtain improvements taking place by following out certain produre. It did not, in his (Mr. Cooper's) opinion, always follow. He elieved the improvement might have been obtained without folwing out the method suggested by Mr. Taylor, provided all her circumstances were equal. In the phenols table of impuries being removed, with regard to the rectification, and the appatus for washing, perhaps somebody present might be able to give me information on the subject of continuous rectification. In gard to the standard of benzol which was to be made, if they ade a 65 per cent. benzol they recovered the so-called toluol action, and ran it back into the scrubber. If it was not outside e range of the paper, he would like one or two opinions as to hether it would not be more advantageous to make 60 per cent. stead of 65 per cent., and get the same selling price for it. He ntended that this could be done with advantage to the works, nd the country would get more toluol. He thought an Association like this might take up the question of testing, and attain me standard methods. Probably most of them would agree at at present they could make a test pretty well what they liked make it.

Mr. TAYLOR said, with regard to the theoretical and practical esults obtained by extracting the benzol from the gas, it was uite correct that they did not exactly correspond. The results hich he had given had been calculated, because it usually epended largely upon the class or volume upon which they were perating. In some plants they were rather cramped for room, r one would think they were. If they were working with tarcrubbers, they required more pumps than they did for rotary crubbers, and pumps took more keeping-up than the rotary crubber engine. He was not aware of any place which was orking a continuous process for rectifying benzol. He knew the rimary distillation had been effected in a continuous manner, nd there was no reason why it should not be adopted; but he hought it would be rather troublesome. They ought to control he fraction. The fractional distillation of alcohol was an old ndustrial matter now; and the distillation of benzene really folowed upon much the same lines. The same type of plant was mployed. Indeed, one of the best arrangements he ever came cross for distilling pure benzene was an old whisky still. With regard to the 60 per cent. benzol, he certainly thought it would pay coke-ovens to make it rather than 65 per cent.; but in some cases the buyers specified 65 per cent., and were going to have it whether they lost on it or not. He hardly agreed with the standard test for benzol proposed. He thought the retort test would give a result within about three-quarters per cent.

Mr. D. V. HOLLINGWORTH, after expressing his thanks to the Secretary for having invited him to be present, said the paper formed the basis of what he hoped would prove a very useful and far-reaching discussion. He did not think there was quite so much doubt as to the composition of the formation of the benzol as perhaps the author believed. As a matter of fact, the formation was at the moment fairly well understood. Syntheses were almost correctly known and tabulated. In regard to the question of loss of illuminating power and calorific value of gas from which benzol had been extracted, he might give an experience of his own. Along with most other gas-works chemists, he had to put up with the inconvenience of the loss in the winter. It had been a very serious matter to those works whose illuminating power had to be kept up to a standard set by law. Particular research was carried out. One chemist was busy determining the calorific value and the composition of the gas at the works, and another chemist, working day and night, was doing the same thing three miles away. Certain facts were established, and the principal one was that without doubt coal gas did lose its benzol content to some extent by transit through the pipes. Then came the question of the proportion; and if he had had a copy of the paper before he came to the meeting he would have been able to bring figures with him. In regard to the principle of this matter, he believed the quantity of hydrocarbon which might rest in coal gas depended on several factors, one of which was how much benzol there was already present. The greater the percentage of benzol in the gas, the greater quantity of hydrocarbons it would carry. Consequently, the amount of creosote which could be carried by the gas depended largely upon the amount of benzol which had been left in the gas, so long as it had contact with some medium which had been carrying the gas. The matter had long since passed beyond the condition of surmise, and had reached that of established fact, as far as the possibility of naphtha remaining in gas or having been denuded of benzol was concerned.

Mr. TAYLOR said Mr. Hollingworth had spoken of the formation of benzene in the gas being well known. It might be so; but to him (Mr. Taylor) it was not well known. It was an old fact, however, that the higher the temperature the greater the formation of benzol series was until about 650°—he thought this was as near as it could be put—the benzol series was formed. Also, that the later formations of coal showed more tendency to distil into paraffins than the earlier formations. For instance, Scotch naphthas would contain from 6 per cent. up to 10 per cent. of paraffins. As to the very interesting remarks that had been made upon the amount of naphthalene carried in the gas, taking coke-ovens altogether the amount of naphthalene in the oil, and consequently removed from the oil with the benzene, varied, and so the amount of naphthalene in the gas varied; but the pressure of naphthalene in the gas was very much smaller than that of the higher naphthas. Although from a gas-works point of view they might strike a happy medium to bring the necessary amount of value, this did not affect coke-ovens practically.

Mr. HOLLINGWORTH: The principle is the same.

Mr. E. M. MYERS said that, though Mr. Taylor had covered a lot of ground in very condensed space, he was a little disappointed in some points. One was the effect of the manipulation of a coke-oven plant on the production of benzol. The result of working a carbonizing plant was made or marred in the carbonizing process; and granting that the plant was ample and efficient, would any reasonable alteration in the manipulation of the carbonizing process affect the figures? In regard to the calorific power of the gas, a works he knew had put down engines to work on coke-oven gas. Shortly after they were installed, the directors thought they would like a benzol plant, and one was put down. The gas-engines were of the old type, and were designed for using a certain calorific power gas. They were very troublesome indeed, like most old-type gas-engines were. When the benzol plant was started, the gas-engines began to stop work; and after close investigation it became evident that there was something wrong with the gas with which the engines were supplied. Whenever anything went wrong with the engines, the benzol plant was shut down, and on ran the engines. Another point he had hoped Mr. Taylor would have touched upon was that of the scrubbing of the gas. He had certainly differentiated between the rotary and the tar-scrubbers; but he would like to have had the experience of members in regard to the time a scrubber worked before it was necessary to clean it. He had heard of them being cleaned no more frequently than once in six years or so; but in his own experience it had been a practice to remove the interior of scrubbers at more frequent intervals—say, twelve months—to clean them. What he would like to know was as to whether, in the installation of rotary scrubbers, against the advantages of decreased ground space and mechanical troubles in the engines, was not the difficulty of cleaning rotary scrubbers greater than that of cleaning tar-scrubbers, and was not the upkeep of the brush gear greater than that of wooden grids in tar-scrubbers? He knew of coke-oven managers whose experience suggested that this was so. Tar plant had been working normally, and something suddenly went wrong. Though the coal was the same, the cleaning was all right, and all other material conditions seemed to be in order, yet the benzol dropped.

He wondered whether Mr. Taylor had any experience to give in regard to the effect of manipulation of the plant—such as suction or back-pressure, and the temperature at which the ovens were worked. He would like to know how to increase the production of benzol by certain manipulations of the ovens themselves, where the production of benzol was started.

Mr. Taylor said Mr. Myers had opened up a big subject. Generally, they found that coke-ovens were run to produce coke, and benzene was more or less an incident. There was no doubt that a reduced temperature would give a higher production of benzol and so forth. This was proved in the days of the strike. With regard to moisture in the slack, coke-ovens were more or less bound also in this respect. They did not always get the slack that they liked. A large number of coke-oven people were doubtful as to whether they should make cake of the slack or pour it in. Although manipulation of the oven might give varying results, they really could not do it. They had to consider the ammonia production. He thought perhaps if, in regard to the plant which went wrong though everything material was in order, the people had to turn out at night a bit they might discover the reason of the strange and uncalled-for reduction in the production of benzene. If all the other conditions were the same as usual, it followed that the benzol must be the same as it was. With regard to the falling-out of the bristles of the brushes in rotary scrubbers, this did take place; and they had to put in new brushes when it did. Those who had had experience of the rotary scrubbers for the scrubbing of ammonia, would have found that the bristles of the brushes were the source of the greater part of whatever trouble they had; but they were very easily taken out and cleaned. If they were using a very heavy oil, there was a tendency to produce anthracene rather than naphthalene; and it would require more drastic treatment. There was a point Mr. Cooper mentioned in regard to steam pressure. If they could get their steam pressure at 100 lbs.—that would be about 160° C. —of course, this would be ample; but as a general rule the steam pressure was much less. If the temperature of the oil was not 110°, he thought they were justified in using superheated steam.

Mr. A. R. Fleming said the author had, after all, limited himself to a comparatively small portion of his subject. Naturally so, since crude naphtha was so complex a mixture. The merit of the paper lay in the new lines of inquiry which it opened. They would find that, with the higher temperatures, they ought to be able to get considerably more efficient washing than was generally practicable. He had himself had considerable experience in this line; and he liked to have a standard method of doing the test. He had only found really two tests which gave results anywhere near—the nitro-benzol absorption method and the absorption method with petroleum oil. There were disadvantages. With regard to the standardization of testing, pioneer workers in coke-oven bye-products plants were in some cases engineers and in others chemists; and they had their different interests and methods of calculation clashing. From the practical point of view, with regard to the effective manipulation of the plant, it was essential to keep a very strict control in the matter of cleanliness of the benzol apparatus. He would like to hear a view as to how low it was safe to keep the temperature of the gas entering the benzol scrubbers. If they were washing with water at a low temperature, they might be liable to wash-out benzol as well as ammonia. In regard further to standardization of methods of testing, a previous speaker had suggested that they could make the ordinary retort test anything they liked. He would point out that the question of manipulation of plant entered into this matter; and the first requisite for perfect working of a benzol plant—revolutionary as the idea might appear—was an efficient chemist. The retort test specially, in the hands of an efficient chemist, could give results within ¾ per cent. This was quite correct. He would have liked to have had a little information in the paper on the formation of benzol not being really understood. He had taken some interest in the methods of low-temperature carbonization and distillation; and he noticed there were some companies who asked for the laying down of a low-temperature carbonization plant, and these had given surprising results. He thought a bright future was in store for a combination of interests which established reliable means of research into the possibilities of the production of fuel oils from various qualities of coal.

Mr. Taylor said that, with regard to the methods for testing the return gas scrubbed for benzol, he quite agreed they seemed to be rather haphazard. The plan generally employed, of using perhaps two or three bottles of creosote oil, and leaving them to look after themselves, was not at all satisfactory; and there was no reason why a standard method should not be put on record. It would certainly pay to experiment in this direction. When all was said and done, the best plan was to use the paraffin method, and freeze it. Alcohol had also been employed, and the method of alcoholizing benzene produced nice results; but they were very erratic, because there were other things with which to contend, and they did not compare with works results. He thought distillation was a better means of getting an accurate result than even weighing. With regard to the question of the absorption of benzol by water in the last scrubber (10 per cent.), if they did have a solution of benzol, it would be a solution of benzol in ammonia water. He did not know the solubility of ammonia water; but he did not think it was anything very appreciable. With regard to the cure for all ills, being a chemist, he took this to be generally accepted. There were people who formed a large amount of benzene by means of manipulating the coal. With regard to the method of treating petroleum oils with steam under pressure and passing them through tubes of nickel and producing spirits, he was not sure whether those spirits were petroleum or partly benzene.

Mr. B. W. Haigh heartily congratulated Mr. Taylor upon the thought-provoking nature of his paper. One of the things suggested particularly was in regard to the quality of the oil so far as having it as free from water as possible. He did not know whether anybody had any method apart from the ordinary one of decantation; but any information in this direction would be a great help if it was not secret. They would all be glad to hear of any means of getting their oil more free from water. He was glad Mr. Fleming had suggested some standard methods of testing; and if the Association resulted in some standardization of methods, it would serve an exceedingly useful purpose.

Mr. Taylor said that, in regard to freeing the oil from water, he had had experience of works where the water was taken from the oil while it was still hot; and it was very satisfactory. The bulk of the water had been got free. No matter what sort of apparatus they had for running-off the water, they were bound to have a fair amount mixed with the oil, unless they kept a very large stock of oil. If the oil were run into a separating vessel while still hot, they could get a very profitable separation. He did not think any great benefit could be derived by using chemicals. In answer to a point raised by another member, he said the whitest salt he had ever seen made was at a place where they used to buy acid tar and put it into open type saturators.

Mr. Fleming said his experience was that it was not the acid tar which was used, but that the acid tar was thoroughly well boiled with steam. Then the heavy carbonized residue was separated from the clear acid. It was this that was separated from the toluol.

Mr. J. W. Lee said it was his firm's plan to boil-up the acid, and run it into the sulphur pans. But there must be complete separation. It must be allowed to settle; and they should see that they got the carbon. The question of water in the oil seemed to be troubling some members. It was quite news to him that on every plant apparently, except his own, it was possible to get water. With an average pressure of 100 lbs. of steam governed by a recorder, in order that the night work might be controlled in the absence of the manager, a top temperature of 108° over the temperature of the oil, leaving the still at an average of 105°, it was possible to keep the water in the oil constantly below 1 per cent. The only thing it was necessary to watch in the Otto plant, of which he had had most experience, was that the heating tubes in the top box were sound. If steam leaked in, there would be water, of course. It was necessary day by day to water; but this occupied only a quarter of an hour or so, with suitable means.

Mr. W. Green said, with reference to this matter of water in oil, the old motto of prevention being better than cure might be applied. On many plants there was not correct and accurate working of the still. On some plants, they were putting water into the oil in the still; and the consequence was that, when they got their debenzolized oil, they had a lot of water in it.

The President remarked that Mr. Green had spoken very truly, when he said prevention was better than cure. This applied to many things which had entered into the discussion. In regard to the question of superheated steam, if the temperature of the oil leaving the steam be kept well above the temperature of the water, the oil would be very largely free from water. Therefore, if a superheater could be used with advantage to the temperature of the bottom portion of the steam, it was worth while. He had had experience of a plant which was producing gas of a calorific value of 480 B.Th.U. per cubic foot some little while after the benzol plant was put in; and they never obtained gas of a higher value than about 440 B.Th.U. For the loss mentioned by Mr. Cooper there was a certain amount of compensation by creosote. With regard to the variation of the production of benzol while the material conditions remained the same, Mr. Taylor had remarked on this; but without doubt the effective carbonizing temperature had a great influence on the yield of benzol. Another speaker in the discussion had mentioned the possibility of getting the gas down to 10° C. He wished that he could always guarantee his at 15°. If they could do this, they would be very happy. They had had a most interesting discussion, and Mr. Taylor had been given a trying time in answering points raised; but he thought the author of the paper had held his own.

Mr. E. M. Myers, in moving a vote of thanks to the author, suggested varying the place of meeting.

Mr. Cooper, in seconding the motion, said he entirely agreed with this idea.

The resolution was carried.

Mr. Taylor briefly responded, and the proceedings concluded.

Coal and Coke Exports.—Among the amendments to the Proclamation dealing with prohibited exports which have been ordered, on the recommendation of the Board of Trade, there is one to the effect that the heading "Coal, all kinds, and coke made in gas-works, but not including coal allowed by the Commissioners of Customs and Excise to be shipped as bunker coal," in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates, should be deleted, and there be substituted therefor the heading "Coal, all kinds, and coke, but not including coal allowed by the Commissioners of Customs and Excise to be shipped as bunker coal.'

SEWAGE SLUDGE FOR GAS MAKING.

Experiments at Stuttgart.

References have been made in the "JOURNAL" from time to ne to the various attempts to utilize sewage sludge for the pro- iction of illuminating gas. In an article in a recent number of Het Gas," Herr C. J. SNYDERS reviews these attempts, and deals ecially with the process in use at the Stuttgart Gas-Works.

In his opening remarks the writer says the authorities of Stutt- irt have tried to combine hygienics and economy by the distilla- on of sewage sludge for the production of combustible gas; and r this purpose a sedimentation tank has been constructed on e site of the gas-works. The initial experiments furnished in- rmation as to whether or not sewage sludge could be carbonized, id under what conditions. It was very soon found that sludge ntaining more than 25 per cent. of water could not be worked, it that with from 20 to 25 per cent. it was possible to carry on stillation regularly; further, that there was no difference in the ogth of the working period for varying percentages of water.

The first trials were made in 1912, when a metric ton of dry idge yielded about 7200 cubic feet of gas having a net calorific wer of 490 B.Th.U. at 0° C. 760 mm. pressure. A more severe ial carried out last year, however, gave the following results:

I.—SLUDGE.

(a) Composition.

	Per Cent.
Total moisture	16·21
Ash	45·58
Combustible matter	38·21
	100·00

(b) Ultimate Analysis of the Combustible Matter.

	As Calculated on Sludge. Per Cent.	As Calculated on Pure Combustible. Per Cent.
Carbon	23·99	62·80
Hydrogen	1·71	4·48
Oxygen and nitrogen	12·32	32·23
Sulphur	0·19	0·49
	38·21	100·00

(c) Coke Test.

Coke is sandy slightly caked . . . 64·75 per cent.

(d) Distillation.

	Calculated on Sludge. Per Cent.	Calculated on Combustible. Per Cent.
Coke free from ash	19·17	50·17
Volatile matter	19 04	49·83
Total moisture	16·21	—
Ash	45·58	—
	100·00	100·00

(e) Net Calorific Power of the Sludges.

2046 calories per kilogramme = 3673 B.Th.U. per pound.

II.—CARBONIZING RESULTS.

Weight of charge in retort	176·4 lbs.
Temperature of oven	905° C.
Duration of working period	4 hours

Results per 100 lbs. of sludge:

Dry coke	67·20 lbs.
Gas liquor	29·60 ,,
Ammonia	0·45 ,,

Production of gas at normal pressure and temperature (15° C.), 5966 cubic feet per ton.

III.—PROPERTIES OF THE GAS.

Specific gravity . . . . ·712

Calorific power at 0° C. and 760 mm. pressure:

Dry gas—Gross, 508 B.Th.U.; net, 454 B.Th.U.

Wet gas—Gross, 472 B.Th.U.; net, 423 B.Th.U.

Illuminating power . . . . 0·34 candle.

Sulphur per 100 cubic metres of gas, 67·8 grammes, equal to 30 grains per 100 cubic feet.

Composition of the Gas.

	Per Cent.		Per Cent.
CO_2	16·2	H_2	36·3
C_nH_m	4·4	CH_4	16·2
O_2	0·1	N_2	10·3
CO	16·5		

For the distillation of 100 lbs. of dried sludge, there are required lbs. of coke and 2 lbs. of breeze. From these figures it is cal- lated that the cost of the retort-firing per 1000 cubic feet of idge gas is double that of coal gas. The coke produced from e sludge has more than 70 per cent. of ash, and a calorific power 1620 to 1800 B.Th.U. per pound. This coke, therefore, can ly be used in ovens for the treatment of town's refuse.

With regard to the economical aspect of the process, it is of im- rtance that a special oven is necessary for the distillation of the idge, and that this makes the process a not very remunerative e, as the gas on leaving the oven has a cost price of at least d. per 1000 cubic feet. On the other hand, it is of interest that e treatment of sewage sludge, which in other systems is a very pensive affair, is made possible in a more hygienic and less stly manner.

They were accustomed in Stuttgart to use the heat of the chimney gases in the ovens for the production of steam. It was therefore determined to try using the heat for the treatment of the sludge, with the result that it was found possible to carbonize the sludge completely at a temperature of 500° to 600° C. by the waste heat of the chimney gases. For this purpose, a trial was made with three wrought-iron tubes, in the lower part of the generator furnace, with bottoms, lids, and ascension pipes complete. The resulting figures were as follows:

Gas production from one metric ton of sludge with 20 per cent. water contents	4865 cubic feet
Net calorific power (0° C., 760 mm. pressure)	416 B.Th.U.
Specific weight	0·694
Carbon dioxide	6·7 per cent.
Production of tar	2·0 ,,
Composition of the tar:	
Water	3·50 ,,
Light oils	26·62 ,,
Middle oils	18·88 ,,
Heavy oils	9·75 ,,
Anthracene oil	13·63 ,,
Pitch	26·25 ,,
Residue	1·37 ,,

These results were such that the installation was extended by building two cast-iron retorts, 8 feet long and 17 by 10 inches internal diameter in the available oven space. Meanwhile, trials were made in the sedimentation basin with the kolazite process. The kolazite sludge gave the following figures:

Moisture	3·40 per cent.
Coke	63·95 ,,
Ash	57·24 ,,
Volatile matter	32·65 ,,

The sludge is recovered in such a form that it can be dehydrated by filter-pressing, so that the content in moisture is lower.

The sludge distilled in the last-mentioned oven produced 6475 cubic feet of gas per metric ton, with a net calorific power of 445 B.Th.U. The gas had the following composition:

	Per Cent.		Per Cent.
CO_2	10·8	CH_4	22·3
C_nH_m	6·1	H_2	41·5
O_2	0·5	N	1·7
CO	17·1		

Each retort charge weighed 1 cwt. of sludge, requiring at 600° to 650° C. a carbonizing period of from 2 to 2½ hours. Per 24 hours it was, therefore, possible to treat one metric ton of sludge with 20 per cent. of water. The resulting experimental data show strong oscillation in the production of gas and in the calorific power; and this may be due to the varying composition of the sludge in connection with the seasons. An experiment of longer duration for stating the average production of ammonia from ordinary sludge gave 0·84 per cent. of ammonia from the dry sludge.

Supposing that a population of 100,000 inhabitants produces 8 metric tons of sludge per day with 60 per cent. of moisture, it will be necessary to treat 4 metric tons of sludge daily, when the moisture is lowered to 20 per cent. For this quantity, eight of the above-mentioned retorts would be required. Taking the production of gas per metric ton of sludge as 7000 cubic feet, the yearly production becomes:

4 × 7000 cubic feet × 365 = 10,220,000 cubic feet of gas.
4 × 2·0 per cent. × 365 = 29·2 metric tons of tar.
4 × 0·65 ,, × 365 = 9·49 ,, ,, ammonia.

When the value of the sludge coke is neglected, and supposing that the calories available from this are about equal to the costs of transport, the sludge gives:

Gas	£730
Ammonia	427

For the working of these eight retorts, one man per eight-hour shift is sufficient.

In consequence of the war and the failing supply of engine oils, it has been attempted to distil engine oil from the tar. For this purpose the fractions were taken between 200° and 300° C. and between 300° and 360° C.

I. Fraction 200° to 300° C.

Specific gravity	1·101
Flash point	192° C.
Solidifying point	− 19° C.

No acids. Bad smell.

II. Fraction 300° to 360° C.

Specific gravity	1·062
Flash point above	225° C.
Solidifies at	− 19° C.

No acids. Tolerable smell.

The last fraction was very good, usable as an engine oil of excellent quality, and gave the same practical results. As cylinder oil the oil was not viscous enough. On mixture with grease a mass of good properties was obtained. As the original tar contains about 30 per cent. of this oil, the tar is of high value.

Much more easily than the treatment of ordinary sludge is the distillation of kolazite sludge. But the kolazite process, which is fairly costly, makes use of the property of iron and alumina salts to form voluminous sediments with hydrates, which sediments include all suspended organic matters. As the sewage sludge is always alkaline, it is only required to add iron or aluminium salts to get a sludge with 20 per cent. of moisture. By adding acids to the sedimented sludge, the metallic salts are extracted, and may subsequently serve, so that the consumption in chemicals is very low. There is consequently, the author contends, some future in the treatment of sewage sludge for the production of gas, tar, and ammonia.

NAPHTHALENE AS A MOTOR FUEL.

A long communication from Herr K. Bruhn, an engineer, of Essen, was published in the "Journal für Gasbeleuchtung" for the 2nd and 9th ult., pp. 579 and 592, on naphthalene and its use as a fuel in internal combustion engines. The following is an abstract of the principal points in the communication.

Production and General Properties.

Searching for new and cheaper fuels for internal combustion engines, attention has frequently been drawn to naphthalene, which demands special consideration on account of its being a solid. It is cheap, and has particular technical advantages. The amount of naphthalene produced is about 0·3 per cent. of the quantity of coal carbonized. This corresponds to a recovery from the tar distilleries and benzol works of Germany of nearly 600,000 metric tons per annum. Generally speaking, tar yields 4½ to 5 per cent. of pure naphthalene. Most of the naphthalene produced in the distillation of coal is removed from the gas with the tar, but a portion, corresponding with its vapour pressure, remains in the coal gas; and consequently naphthalene is often deposited in the solid state in the distributing system, causing obstruction. In order to avoid this, the naphthalene is frequently removed from the gas by washing with heavy tar oils, which, when saturated, are generally worked-up with the tar.

The naphthalene is recovered from the tar oil distillates in varying degrees of purity; the purer grades naturally being more costly. Naphthalene contains less hydrogen than benzene, and, being a product of high temperatures, is stable, and has a high temperature of ignition. The latter property is advantageous for motor purposes, since it admits of a higher compression being used. Pure naphthalene is quite white, melts at 79·6° C. (175·3° Fahr.), and boils under the normal pressure of 760 mm. at 218° C. (424° Fahr.). The large interval between the melting and boiling points favours the use of naphthalene in the liquid state, as in engines. In the molten condition it is a clear colourless liquid. On passing from the solid to the liquid state, its volume increases considerably—a property which has to be taken into account in designing plant in which it is to be employed or worked up.

The specific gravity of liquid naphthalene at 80° C. is 0·977; that of solid cast naphthalene at 15° C. is 1·15. Impure naphthalene has a lower melting point and a higher specific gravity than the pure. The fusion of naphthalene entails a comparatively small expenditure of heat, as the latent heat of fusion is only some 36 calories. The viscosity of liquid naphthalene at 80° C. is 1·11° Engler. The high vapour pressure of naphthalene is noteworthy, and is responsible for the difficulty there is in removing it from coal gas; but, on the other hand, for motor purposes it facilitates the formation of practicable mixtures of the fuel and air. The flash point in the Pensky-Martens apparatus is 80° C.; the temperature of ignition in an open crucible is 98° C.

Theoretically, 1 lb. of naphthalene needs 162 cubic feet of dry air for its complete combustion. The complete combustion of naphthalene in the form of vapour or gas is attended by an increase in volume; 13 volumes of the mixture of naphthalene and oxygen yielding 14 volumes of carbonic acid and water vapour. The gross calorific power of naphthalene is 9600 calories per kilogramme (17,280 B.Th.U. per pound); but the net calorific power, which is of importance in its use in motors, is about 9300 calories per kilogramme (16,740 B.Th.U. per pound). Attempts have been made to use a solution of naphthalene for motor purposes; and on this account its solubility in various solvents is of importance. It is insoluble in water, but is dissolved by the following solvents in the percentages by weight stated: Alcohol at 10° C. 5·00, at 0° C. 4·25; petroleum ether at 10° C. 11·05, at 0° C. 7·75; benzene at 10° C. 40·70, at 0° C. 32·00; toluene at 10° C. 35·30, at 0° C. 24·80; xylene at 10° C. 29·00, at 0° C. 20·80.

The addition of naphthalene to benzene lowers the freezing point of the latter—a matter of importance in the production of benzol for motor purposes for use in cold weather. Benzol which crystallizes at 41° Fahr., on the addition of 30 per cent. of naphthalene deposits no solid matter even at 26·6° Fahr. Naphthalene vapour has the peculiarity that, on cooling below the melting point, it does not pass through the liquid state, but forms directly solid glittering rhombic flakes. Pure naphthalene is employed in colour works in the manufacture of artificial indigo and aniline colours, and in explosive works for producing modern explosives and detonators, and as a solvent for phosphorus, sulphur, and indigo. In the crude state it is largely used for the manufacture of lamp-black. Compressed hot, it has been used by many works during the present war as a substitute for fuel oils for various industrial furnaces. The naphthalene used for motor purposes is nearly pure, but is apt to be grey or brown instead of quite white. The colour is, however, of no importance.

The Naphthalene Engine.

The four-cycle gas-engine was rapidly adapted for the consumption of gasoline and similar liquid fuels, of which benzol as a home product received special recognition in Germany. With the development of the automobile, the demand for liquid fuels increased enormously, and attempts were made to replace benzol by naphthalene. Naphthalene has the advantage of yielding a vapour of uniform composition; but, on the other hand, it has to pass from the solid through the liquid state for vaporization. Hence a naphthalene engine must be provided with a vessel for melting the naphthalene, which, with the connections and all parts with which liquid naphthalene comes in contact, must be kept hot enough to prevent solidification. The first practicable engine was produced by the Deutz Gas-Engine Works in November, 1907, and a few years later Messrs. Benz and Co. started making naphthalene engines. In the middle of the year 1914 there were about 1000 such engines at work. In 1911, the output of naphthalene engines was 68, with an aggregate of 678 H.P. and consuming 75 metric tons of naphthalene per annum; in 1912, the output had increased by 283 engines, aggregating 2961 H.P. and consuming 509 metric tons of naphthalene; while in 1913 the output had further risen to 367 engines, aggregating 3934 H.P. and consuming 1423 metric tons of naphthalene per annum.

The naphthalene engine generally consists of a single or at the most a twin cylinder four-cycle horizontal engine following in its principal lines the model of the Otto engine. Above or alongside the cylinder with its cooling jacket there is a double-walled naphthalene fusing tank, from which a heated tube leads to the carburettor through a float-valve and a sprayer inserted in the pipe supplying air to the cylinder. The naphthalene fusing tank is heated by waste heat from the engine. In the earlier engines, as devised by Lion, the naphthalene was rapidly melted by the exhaust gases; but this was attended with the disadvantage that over-heating and too free an evolution of vapour were liable to occur. The Deutz Gas-Engine Works adopted the plan of melting the naphthalene by the heat of the cooling water, which avoided overheating the naphthalene. In the older Deutz engines the cooling jacket of the engine cylinder was connected with a large cooling water tank, in which the water after a time came to the boil. In this tank the naphthalene receptacle was suspended. The naphthalene was liquefied by the heat of the cooling water and the escaping steam. The hot water surrounded all adjacent parts in order to prevent the melted naphthalene from solidifying; but even so it was found that the naphthalene solidified in the sprayer unless the air supply had been previously warmed. The heat of the exhaust gases was therefore used to raise the temperature of the air in the suction pipe to 120° to 150° C.

In later Deutz engines there is a small water-tube boiler (heated by the exhaust gases) which communicates with the cooling jacket of the engine and so raises the temperature of the water to boiling more quickly after the engine is started than is the case when the cylinder heat alone is relied on for the heating of the water. The naphthalene is thus melted more quickly than in the old type of engine.

Engines constructed on these lines obviously cannot start on naphthalene from the cold; they have therefore been designed to start from the cold with gas or liquid fuel. After running a certain time on such fuel, and having become warm, the change-over is made to the consumption of naphthalene. An independent source of heat may also be used to enable the engine to start direct on naphthalene. A separate induction pipe and sprayer are now generally provided for the liquid fuel used in starting the engine from the cold. Naphthalene engines have only been constructed for sizes of 4 to 20 H.P. per hour; but in consequence of the increase in the price of liquid fuels caused by the war, larger units are now being constructed. Naphthalene is also being used for Diesel engines.

Efficiency of the Naphthalene Engine.

Some efficiency trials have been made on a Deutz 6 H.P. naphthalene engine at the Royal Engineering School at Essen. This engine was built in 1912, and was used at a works in Central Germany for nearly a year before it was transferred to Essen. It is of an old type, with the naphthalene tank placed above the cylinder. The flow of liquid naphthalene to the sprayer is controlled by a float, just as with petrol engines. The flow of the napthalene or mixture is controlled (according to the load) by a centrifugal governor. The diameter of the cylinder is 6·7 inches, the stroke is 9·5 inches, and the engine makes 260 revolutions per minute. The total cylinder volume is 400 cubic inches, and the compression space is 67 cubic inches.

The preliminary running was made on benzol. The benzol consumption during this period was from 9·81 to 9·88 oz. per horse-power-hour; the load being from 5·6 to 8 H.P., and the exhaust was good, containing 15·8 per cent. of carbonic acid. The naphthalene consumption for loads from 4·1 to 6·7 H.P. varied only between the narrow limits of 9·95 to 11·37 oz. per horse-power-hour. The increased consumption of naphthalene as compared with benzol is only proportional to the lower calorific power of naphthalene, which is 16,740 B.Th.U. per pound, compared with 17,280 B.Th.U. per pound for benzol. The exhaust was good, and contained from 15 to 15·6 per cent. of carbonic acid and from 2·4 to 3·9 per cent. of oxygen. The consumption of cooling water and lubricating oil was small. Difficulty was experienced in obtaining good diagrams, owing to the naphthalene vapour being expelled from the cylinder and solidifying on the

Consumption at	Half Load.		Three-Quarter Load.		Full Load.	
Fuel.	Consumption	Cost.	Consumption.	Cost.	Consumption.	Cost.
	oz.	d.	oz.	d.	oz.	d.
Petrol . . .	16·6	2·16	13·1	1·68	11·3	1·44
Benzol . . .	14·1	1·44	10 6	1·08	9·5	0·96
Naphthalene.	13·4	0·55	11·3	0·47	10·2	0·42

indicator piston. The consumption of naphthalene at loads below the normal showed the same proportional increase per horse-power-hour as is usual with motor spirit.

The foregoing table of the cost of naphthalene in comparison with other motor fuels has been made up by Herr Stauf. Taking the price of motor spirit at £19 6s. 6d. per ton, benzol at £15 4s. 9d., and naphthalene at £6 2s., the relative consumption and cost of fuel are as given in the table.

The figures are clearly extremely favourable for naphthalene. The temperature of the completely liquid naphthalene in the fusing tank during working was 97° C. There was very little smell of naphthalene in the engine room. The other charges with a naphthalene engine are very little higher than with a benzol engine of equal power. Hence the relative economy is indicated by the cost of the fuel. The author proceeds to compare the working expenses of an electromotor, a benzol engine, and a naphthalene engine, all of 6 H.P. for different loads for 3000 working hours; the cost of fuel being taken on the foregoing basis. The capital cost of the alternating current electromotor with switchboard and foundation is taken at £37 10s.; that of the benzol engine, including the fuel tank and foundation, at £112 10s.; and that of the naphthalene motor, including the fuel tank, heating arrangements, and foundation, at £130. Current is taken at 2·4d. per unit. The cost of working, including interest, depreciation charges, attendance, lubrication, and fuel or current, works out at 2·17d. to 2·46d. for the electromotor, 1·26d. to 2·09d. for the benzol engine, and 0·82d. to 1·39d. for the naphthalene engine; the first figure in each case referring to full load, and the second figure to half load—all per horse-power-hour.

Care should be taken in the storage of the naphthalene. Often the sacks containing it are placed or moved about on a dirty floor on to which naphthalene soon escapes through rents in the sacks. Apart from the loss of naphthalene, there is great risk, with this method of storage, of dirty naphthalene being put in the fusing tank and causing obstruction of the gauze on the outlet of the tank or of the sprayer of the carburettor. In order to avoid this difficulty, measures have been taken in Germany to supply naphthalene for motor purposes in the form of well compressed briquettes of quite convenient size. These briquettes are readily packed, do not absorb dust or moisture, and their size renders breaking unnecessary for hand feeding of the fusing tank on the engine. The colour of the briquettes is naturally rather darker than that of powdered naphthalene; but this does not imply that they contain injurious impurities.

The naphthalene engine shows to best advantage in works in which it is required to run for long periods after starting-up. Many such works may be mentioned—such as small water-works and mills (either as the sole source of power or as a supplement to water power).

The economy of the naphthalene engine, and the small fire risks in the storage of naphthalene as compared with liquid fuel, have led to trials of these engines for automobiles. Such trials made in France with engines up to 40 H.P. have been reported on in the Technical Press. For automobile purposes it is advantageous to liquefy the naphthalene by other means than heating; and benzol being obviously the best solvent for naphthalene, the majority of the attempts to use dissolved naphthalene as a fuel have been made with its solution in benzol. A saturated solution, however, when cooled, deposits naphthalene in the solid state, and the same thing occurs on partial evaporation of the solvent. Hence the mixture must be one well below the saturation point. Various expedients have been adopted to limit the quantity of naphthalene dissolved in the benzol, and the addition of comparatively small proportions of naphthalene to benzol has been made with complete success in the working of automobile engines.

The author concludes that the use of naphthalene as a fuel for small engines can be greatly extended with advantage, and that the attempts which war conditions have provoked to replace benzol by naphthalene are likely to end in the ultimate adoption of naphthalene as a fuel for commercial motor vehicles.

Scottish Junior Gas Association (Western District).—The result of the adjudication by Mr. Walter Grafton, of Glasgow, on last year's papers read before the Association is that the first prize is awarded to Mr. A. Peter Dale, of Beith, for his paper on a "Country Gas-Works, Past and Present," and the second prize to Mr. D. Fulton, of Helensburgh, for his paper on "Carbonization in Vertical Retorts."

Royal Institution Lectures.—Among the lectures to be delivered at the Royal Institution early next year are three by Professor W. A. Bone, F.R.S., on the "Utilization of Energy from Coal." The first of these, to be given on Jan. 20, deals with the chemistry and economics of coal and its bye-products; the two succeeding discourses having for their subjects fuel economy from the national standpoint and industrial applications of gaseous fuels derived from coal.

Institution of Civil Engineers.—The elections and transfers reported at last Tuesday's meeting of the Institution included the transfer in April from the degree of associate member to that of member of Mr. T. S. Lacey, of the Beckton Gas-Works. Among the elected members was Mr. H. R. C. Blagden, of the Alexandria Water Company; and among the elected associate members were Mr. D. A. Howell, of the Llanelly Water-Works, and Mr. A. S. F. Mody, Water Engineer, Ernakulam (S. India).

DEFINITION OF TERM "DOMESTIC PURPOSES" IN GENERAL AND PRIVATE WATER ACTS.

By A. B. E. Blackburn and Percy Griffith.

[A Paper read before the Institution of Water Engineers, Dec. 10.]

Having collected a considerable mass of data relative to the various applications and definitions of the term "domestic purposes" at present incorporated in General and Private Water Acts, the authors have accepted an invitation from the Council to prepare some notes on the subject for presentation at a meeting of the members with the view of opening a discussion thereon. It must, however, be clearly stated that these notes do not represent the views of the Council, and are to be considered not in any way as an official report to the members, but merely as a summary of points open to discussion.

Defining the Term "Domestic Purposes."

As the question of defining the term "domestic purposes" is one in connection with which the interests of water authorities and consumers frequently come into conflict, while at the same time the interests of the public health suggest considerations independent of both, it will be generally conceded that the subject must be approached and discussed on the broadest lines.

The essential difficulty of the problem in this country arises from the impossibility of charging for water supplied for domestic purposes on the basis of quantity consumed. The public interests are generally admitted as demanding: Firstly, that a quantity sufficient for health must be supplied; and secondly, that the payment for this quantity must be adjusted according to the financial position of the consumer rather than to the actual amount of water consumed. Thus, the charges for a "domestic" supply are usually based upon the annual (rateable) value of the property; but, as a directly proportionate charge would create an excessive disproportion between the charge and the consumption, the scale usually varies between 5 per cent. and 10 per cent. of the annual (rateable) value, but in inverse ratio thereto. This system has been applied, with slight adjustments to meet special cases, almost universally; the most prominent exception being the Metropolitan Water Board, who, in their Act of 1907, adopted a uniform rate of 5 per cent. This uniform rate, however, has aroused considerable opposition in certain cases, and has resulted in many consumers providing themselves with private supplies of water. Thus it may be fairly claimed that, as the normal system has successfully stood the test of experience without creating any general hostility or justifying serious criticism, no change is at present called for. While, however, the present method of charging for "domestic" supplies of water may, on the whole, be regarded as satisfactory, it is otherwise with the method of differentiating between "domestic" and "non-domestic" supplies.

It may here be of interest to recall the circumstances under which the term "domestic," as applied to water supply has come into use. In the earlier Acts of the Metropolitan Water Companies no charges were stipulated; the supply of water was a voluntary arrangement between the consumers and the companies. Scales of charge based on the number of rooms in the house were later introduced; this number being arrived at by the number of chimneys, in order to avoid the necessity for the internal inspection of the premises by the water companies' officials. Then followed the addition of special charges for high-service, baths, water closets, &c., as well as for trades requiring an extra consumption of water the whole being a question of mutual agreement and not of statutory charges.[*]

In the year 1847, the position of all existing and future water companies was standardized by the Water-Works Clauses Act of that date, into which was introduced the important factor of compulsion on the water authority to "provide and maintain a supply of pure and wholesome water sufficient for the domestic use of all the inhabitants," all other supplies (except water for municipal purposes and fire-extinguishing) being permissive. This Act made no provision for charges, beyond stipulating that domestic supplies were to be paid for by a rate based on the "annual value of the tenement;" water used for municipal purposes was to be paid for upon such terms as might be agreed upon or, in case of disagreement, as should be settled by two Justices; and water for fire-extinguishing was to be supplied without charge. The Act of 1863 standardized certain purposes as being "non-domestic;" and these were consequently rendered non-compulsory and subject to agreement as regards payment.

The position has since remained unaltered as regards the general water-works law; but Private Bill Legislation has introduced many variations, some peculiar to certain undertakings, others, however, being subsequently standardized by incorporation in the Model Water Bill. In fact, the Model Water Bill has played an important part in the whole question, because, by standardizing certain clauses which experience has shown to be necessary and of general application, it has, up to the present, obviated the necessity for revising the general water-works law. It will, no doubt, be generally agreed that, whether any alteration of existing conditions in regard to the definition of "domestic supply" is necessary or not, the time has now arrived when the general law should be brought into closer conformity with generally accepted practice.

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[*] The authors are indebted to a report by Mr. A. B. Pilling, the Clerk to the Metropolitan Water Board, published in July, 1915, for the historical data contained in this paragraph.

Reverting to the question of "domestic" supplies, the most important factor in the General Water-Works Acts is the obligation imposed on "undertakers" to afford a supply. In these Acts the compulsion applies solely to "domestic" and municipal supplies, and to water used for fire-extinguishing. Several Private Acts, however, have incorporated compulsory clauses relative to "non-domestic" supplies; the most important being the Sheffield Water-Works Act, 1853 (section 81), the Staffordshire Potteries Water-Works Consolidation and Extension Act, 1853 (section 47), and the Metropolitan Water Board (Charges) Act, 1907 (section 16)—the rates of charge being stated in each case. Where no compulsion exists, the water authority has absolute discretion as regards the charges made for "non-domestic" supplies—being free to refuse the supplies unless its terms and conditions are complied with in each particular case.

PUBLIC HEALTH POINT OF VIEW.

Considering the question of compulsion apart (for the moment) from that of charges, and taking the broader view suggested by the modern requirements of public health rather than that of the consumer anxious to resist an extra charge, or that of a water authority anxious to maintain or increase its revenue, it cannot be denied that modern ideas of sanitation involve a much larger consumption of water for domestic purposes than they did in the year 1847. And this extra supply has generally been afforded without demur by the water authorities. At the same time, there is no doubt there has been a general, and in most cases an extraordinary, increase in the demand for trade purposes (supplied at remunerative rates of charge), and also an increase in the annual (rateable) values upon which the domestic supplies are charged. For these reasons it is quite possible that some considerable extension of the domestic use of water might be permitted without any protest from water authorities generally, as it must be admitted that water authorities have, for the most part, considerable scope in the direction of preventing waste and improper use of water by consumers. Nevertheless, it may fairly be asked whether it is not time to reconsider the whole question of domestic charges on its merits, and devise a method, firstly, of limiting the application of the term "domestic purposes," and, secondly, of adjusting (if necessary) the rates of charge as between "domestic" and "non-domestic" user. From the point of view of public interest there should not be any question of competition between the claims of water authorities and consumers respectively. It may be assumed that the revenue of any authority—whether municipality, joint water board, or company—is already sufficiently governed by Statute to prevent the necessity for any material diminution of it. Consequently, any modification of the existing conditions must be in the nature of an adjustment as between one class of consumer and another. This assumption being conceded, the authors will, perhaps, be justified in admitting the possibility of extending the application of the term "domestic supply" from the point of view of public health.

The development of modern sanitation in the direction of providing closets and private fixed baths for even the smaller tenements, as well as the closer supervision of the internal sanitary conditions of all classes of property, including factories, workshops, &c., tends inevitably to the more liberal use of water for purposes which, in the interests of public health, must be classed as "domestic"—using the word in its original and broader sense. The first question, therefore, to consider is to what extent ought the term "domestic purposes," as used in General and Private Water Acts, to be interpreted to include all water required in the interests of public health?

As, for the moment, we are considering the matter apart from the question of charges, it may fairly be claimed that all water required to maintain cleanliness, of persons, of utensils, and of inhabited premises, as well as that necessary for private sanitary and culinary use, should be considered as coming under the term "domestic supply," and that such water should, therefore, be supplied compulsorily in the interests of public health. The further questions of what quantity of water, and what specific uses of water are to be considered as essential to health, should be carefully considered and settled by sanitarians, just as in the matter of defining the term "pure and wholesome water" a standard should be fixed by chemists and bacteriologists. The water engineer will then know what is required of him, and be able definitely to calculate his liabilities both in regard to quantity and quality. At the present time the lack of agreement in the matter of purity and the absence of any standard of quantity required for health purposes are frequent causes of dispute or misunderstanding; and the authors suggest that, until some standards have been adopted by common consent, the problems of defining "domestic supply" and "pure and wholesome water" must to some extent remain unsolved.

CONSUMER'S POINT OF VIEW.

Let us next consider the subject from the consumer's point of view. It must not be forgotten that in civilized communities the interests of the individual cannot be dissociated from those of the community at large, and in regard to water supply, the individual consumer must be prepared to pay his fair share of the cost of water which is necessary for the maintenance of public health. Moreover, in order to relieve himself and his neighbours from excessive or unnecessary cost, the consumer must be prepared to co-operate with the water authority in checking the waste or improper use of water, and to accept without complaint such supervision of his water-fittings or use of water as may be necessary to enable waste or improper use to be detected and prevented.

This feature of the case becomes of particular importance when we consider the subject from the water engineer's point of view; but the consumer must be involved in any practical scheme for differentiating between the water used for "domestic purposes" and that used for "non-domestic" or "extra-domestic" purposes, whatever may be decided as the proper dividing line between the two. As regards payment also, the consumer must be made to realize that, in securing any extension of his "domestic" water supply, he is not being relieved of the necessity of bearing his proper share of the total cost, nor obtaining any advantage as against the water authority or the community as a whole. Any extended use of water for domestic or health purposes should be considered as a necessity in the public interest, and not as a personal convenience or luxury to the consumer, and he should also, in his own interest as a member of the community, be willing to restrict his demand for and use of water to those purposes which are strictly necessary, and to pay for any additional consumption as a convenience or luxury according to value received. Whether these ideals can be carried out on practical lines is, of course, open to discussion.

WATER ENGINEER'S POINT OF VIEW.

Turning, now, to the water engineer's point of view, the difficulties of differentiating between "domestic," "extra-domestic," and "non-domestic" supplies at once become evident. In order to appreciate them more clearly, it will be convenient to eliminate those cases which do not present any difficulty at all. First among these are the cases of indisputable "trade" supplies. In all manufacturing areas a considerable proportion of the water supplied is used for exclusively trade purposes; and in cases of factories and workshops occupied only during working hours, the only difficulty arising is to what extent water used in closets, lavatories, and for scrubbing the premises should be considered as "domestic supply." In this connection the question of compulsion must be considered apart from that of charges. The sanitarian may fairly claim that water so used is necessary in the interests of the public health, and should be supplied under compulsion; and, therefore, it is not right that the water authority should have power to refuse such a supply unless it is taken on their own terms and conditions. It seems a fair subject for discussion whether or not trade supplies (which may be assumed as universally metered) should be considered as compulsory as far as they may be required or used for "domestic" or health purposes. It may be pointed out that in the case of all supplies made compulsory by Statute, the scale of charge, or at any rate a maximum rate of charge, is also invariably settled by Statute. It does not, however, appear to the authors that any serious difficulty arises in making the conditions referred to, although, of course, the making of trade supplies, even partially, compulsory would be an important change in present parliamentary practice.

Another, although much smaller, class of supplies which presents no essential difficulty is that of private residences (particularly small properties without gardens or stables), where water is used for "domestic" or health purposes and for nothing else. Were it generally agreed that water used for closets and private baths should be considered as "domestic" supplies, this class would be extended greatly, and the problem would be, to this extent, simplified. This, however, is a question upon which discussion may be useful and interesting.

The third, and the largest, class of supplies as to which the practical difficulties are, at first sight, most apparent and insuperable, is that of premises where water is used both for "domestic" and "non-domestic" purposes. In this must be included the private residence with a needless multiplicity of lavatories and other sanitary conveniences, with gardens, greenhouses, stables, ponds, or fountains; the combined residence and shop (whether for work or sale of goods); the factory, with a resident caretaker or workpeople; and hotels, inns, and restaurants. In such cases the "non-domestic" supply cannot economically be metered—at any rate, as a general rule; and it becomes a question of great practical difficulty how to differentiate between the "domestic" and "non-domestic" supplies, both in regard to compulsion and to scales of charge.

Specific cases of restaurants, workhouses, schools, laundries, &c., have been decided in the Courts on their individual merits; and while the decisions in such cases cannot be accepted as of universal application—indeed, the decision in the cases of *Metropolitan Water Board v. Avery* and *Metropolitan Water Board v. Oddenino* appear to the lay mind absolutely contradictory—the arguments used by Counsel and the Justices in the various cases afford interesting reading to anyone anxious to analyze the ethical basis of the present legal position. To the water engineer, the reading of these cases can only enforce the conclusion that at present the law relating to "domestic supply" is hopelessly vague and unconvincing; and the authors venture to suggest that the explanation lies in the fact that up to the present no serious attempt has been made to define the essential principle underlying the use of the term "domestic supply" in water-works law.

This problem, however, is not primarily one for the engineer;

ıd it must be left to the Legislature, guided by the sanitarian, prescribe the dividing-line between "domestic" and "non-omestic" purposes in regard to water supply. Nevertheless, it not inopportune for the water engineer to intervene at this age in order that he may indicate to the Legislature the prac-cal difficulties which ought to be considered before any new or ore drastic enactments are made; and this paper has been pre-ared mainly to enable members to express their views as to the ethod of meeting the case, having regard to the interests of ıblic health and the consumer on the one hand, and of the water ıthority on the other.

Main Objects in View.

The main objects in view appear to be, firstly, the introduction a comprehensive, yet indisputable definition of the purposes r which water must be supplied compulsorily; secondly, a prac-cable method of supplying such water separately from the non-ompulsory supply so far as may be necessary; and, thirdly, a stem or scale of charges which would be equitable as between fferent classes of consumers, of general application as regards e principle, yet sufficiently elastic to provide for the varying con-tions of different localities and different sources of supply.

The authors venture to suggest that these problems will shortly ave to be faced—that unless those responsible for the water ndertakings of the country are prepared to consider them in a ractical manner, it is probable that the Legislature will take ome action which will seriously disturb the present system of ıpply and method of charging, and possibly cause further com-lications and difficulties which the water-works engineer and anager will have to unravel and overcome as best he may. It , moreover, to the interest of water-works engineers to simplify much as possible the legal or statutory obligations of water ıthorities in regard to their consumers, and thus avoid the un-ertainty and confusion which now so generally prevail. Any teration in the law should certainly have in view, not only the terests of the water authorities and their officials, but also those the public, who suffer quite as much from the present condition affairs.

Should the discussion furnish material from which a practical heme for reforming the existing water-works law could be rawn up, the authors do not doubt that the Council would seri-usly consider the best means of promulgating such a scheme nd assisting the Legislature to give effect to it; but, in any vent, they are confident that the discussion should prove both uitful and interesting to water engineers as well as to others oncerned in the question of public water supplies.

Having stated the main objects in view, and assuming the esirability of attempting to carry them into effect, the authors ropose to consider the points in some greater detail, and par-cularly to mention some of the suggestions that have been made connection with each.

1.—*Definition of the Purposes for which Water should be Supplied Compulsorily.*

The term "domestic" is here purposely omitted, because it eems desirable that, in any revision of the general water-works ıw, the element of compulsion should be dealt with specifically, nd it is assumed that water required for municipal purposes—ewer-flushing, road-watering, &c.—as well as for fire-extinguishing ould remain under this heading, with perhaps a more convenient asis of charge for the former than is now suggested in the Act of 847. Possibly the members present may wish to question the bligation to supply water for fire-extinguishing free of charge; ut generally these two classes of compulsory supply do not ppear to call for much comment.

The present method of defining "domestic purposes" is, how-ver, generally admitted to be unsatisfactory, and mainly because t is almost exclusively in the negative form. This form is objec-ionable in that, unless every other possible use for water is speci-ied, the definition must be incomplete. The authors have col-ected many suggestions for a positive definition; but all seem to e open to adverse criticism. Nevertheless, a few specimens may erhaps facilitate discussion and elicit further and more suitable lefinitions.

(*a*) A water supply for domestic purposes shall mean a supply laid on to private premises for the usual family purposes of the household and no other.

(*b*) A water supply for domestic purposes shall mean, and be limited to, water used exclusively in providing for the personal, sanitary, culinary, and ablutionary requirements of residents,

(*c*) The term "domestic purposes" shall mean the purposes for which water is required to be supplied to premises used partially or wholly as private dwelling houses, and shall apply only to such a supply of water as is necessary to the health and comfort of the persons resident in or occupying such premises.

Definition (*a*) would seem to raise a vista of further litigation. as it involves the defining of "usual family purposes."

Definition (*b*) has the merit of simplicity, as it deals solely with the purposes for which the water is to be used; but in practice it would raise endless difficulties, as its meaning is qualified by confining the domestic use to residents without any reference to the character of the premises supplied. It would seem to be difficult to arrive at a satisfactory definition which is not two-fold in character, involving reference to, and limitation of, both the purposes for which the water may be used and the nature of the premises to be supplied.

Definition (*c*) covers the two points. But here, again, it would be necessary to have a decision on what uses of water are covered by the words "necessary to the health and comfort." In connection with this definition, it will be useful to consider how far water authorities should, in the interests of public health, abandon the standard clause which entitles them to refuse to supply except by measure "any building used by an occupier as a dwelling-house, whereof any part is used by the same occupier for any trade or manufacturing purpose for which water is required."[*] In all such cases water for "domestic purposes" should, in the interests of public health, be supplied compulsorily; and the only difficulty that arises is how far the "non-domestic" supply could be, in case of necessity, restricted. [The question of charges will be dealt with later.] The provision of separate services would be in most cases extremely inconvenient and costly, and the use of meters on all "non-domestic" supplies is also put out of the question. Nevertheless, the water authority may reasonably ask for power to restrict the supply of water for such purposes in all cases where meters are not applicable; and the question is how can this be effected otherwise than by charging sufficient to cover excessive consumption, as is now done? This question leads naturally to the second problem.

2.—*To what Extent is it Necessary or Possible to Supply Water for "Non-Domestic" or "Extra-Domestic" Purposes separately from that Required for "Domestic" Purposes?*

A suggestion has been made that a given quantity of water (calulated proportionately to the number of residents) might be adopted as a reasonable consumption requisite for "domestic purposes," and that all excess consumed should be considered as "non-domestic." But this involves the necessity of—at least, periodically—measuring the consumption, and the further difficulty of arriving at a fair allowance for "domestic" use. Undoubtedly a separation of the two supplies would overcome many difficulties, both as regards restriction of use and charges, and the question how far such a proposal could be carried out is perhaps worthy of discussion, even if it is found that the difficulties of its adoption prove insuperable.

3.—*The Best System of Charging for "Non-Domestic" or "Extra-Domestic" Supply.*

In view of the suggestions made in regard to extending the application of the term "domestic purposes," it is necessary to point out that any appreciable increase in the quantity of water to be supplied compulsorily, and under the usual scale of charges for "domestic use," must involve a reasonable increase in the percentages on annual (rateable) value now in common use. Should the Legislature move in the direction indicated, this claim would no doubt be taken into consideration. As regards "non-domestic" or "extra-domestic" charges, however, practice differs widely, owing to the fact that all such supplies are optional and subject to agreement. The publication of "Tables of Special Charges," and the power to refuse such special or "non-domestic" supplies except on payment of such published rates, considerably negatives the idea of agreement between water authorities and consumers, as it practically gives the former full discretion to charge as they may see fit. Now it may be quite reasonably urged that many "non-domestic" uses of water are beneficial to the community, as, for example, supplies to trades which may be attracted to a particular area because the charges for water are low. Then it may also be urged that charges for similar purposes should be uniform in any given district, so as to avoid preferential treatment to particular consumers; and generally it may be claimed that special charges should have some more definite statutory authority than is now the case.

Is it not, therefore, desirable to consider carefully the conditions affecting the various "non-domestic" or "extra domestic" supplies, and, as far as possible, to classify them under heads, such as the following? (*a*) Those to be supplied only by measure. (*b*) Those to be charged for by an increase or decrease of the "domestic" scale. (*c*) Those to be charged for by an annual or quarterly sum. (*d*) Those to be charged for on other terms—that is, by mutual agreement where not specifically provided for in the Private Act.

Such a classification might be of general application, and thus secure the advantages of uniformity and simplicity. The actual charges could not, of course, be standardized; but it is suggested that it should be a more general practice to schedule special charges to Private Acts, so that there could be no doubt as to the charges being authorized by Statute. To avoid the inconvenience and expense of promoting Private Bills when it was desired to alter the charges or add new items to the list, it seems to the authors that alterations of the special charges might be made from time to time subject to the approval of the Local Government Board.

The authors fully realize the complex nature of the subject, and that many of the suggestions contained in the latter portion of these notes may appear crude, impracticable, and perhaps unnecessary; but they have ventured to introduce these few points to facilitate discussion.

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[*] Model Bill (1914), clause 16.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Price of London Pitch.

Sir,—We thank you for your comments on our letter on the above subject published in the "Journal" dated Dec. 7. You seem to be rather severe on us when you say that an assertion we have made was open to "gravest doubt." Our figures were based on facts; and cargoes of upwards of 1500 tons are regularly shipped from the supplying works. We could have bought a larger quantity than we could see our way to handle; and other buyers could have made equally favourable purchases.

Certainly, the largest makers have a natural right to be heard; but that does not mean that other voices should be silenced. Taking the term "largest makers" in the singular, suggests to us that possibly your reporter obtained his information from one source only. Experience has taught us the danger of doing so; and in the interests of the trade generally, and for the sake of arriving at some degree of accuracy, we should be very glad to compare notes with your reporter, if he would do us the honour to confer with us before fixing values each week.

You make a decided concession to our views when you state that your reporter puts the average value of London pitch for September-October at 24s. 6d. Your weekly reports give an average of 26s. for the same period.

Although we said that we did not doubt that certain contracts referred to by you were *boná fide*, we would remind you that we also said we should have preferred the actual dates of same to be stated.

Lastly, Sir, may we again point out to you that as late as the week ending Nov. 30, your reporter indicated that the price of pitch was still about 26s. Your report of Dec. 7, however, gave the London value as 20s. This points to a drop of 6s. in one week. The market in our opinion certainly did not drop 6s. per ton between Nov. 30 and Dec. 7. Clearly, therefore, the fall must have commenced some time before the former date; and we again beg to submit that the figures which we have put forward represent the correct market value.

We should like to mention here that the average value of London pitch for the month of November as compiled by us is 17s. 6d. per ton.

4, *Lloyds Avenue, E.C., Dec.* 15, 1915. BLAGDEN, WAUGH, AND CO.

[Contrary to our correspondents' suggestion, it may be stated that our reporter has more than one source of information. It is singular, however, that while Messrs. Blagden, Waugh, and Co. ask for dates, &c., of others' information, they fail to indicate either the date or the quantity of any business supporting their statement which we doubted was representative of the market. Nor is their remark, "as late as the week ending Nov. 30 your reporter indicated that the price of pitch was still about 26s.," fairly representative of the facts, as a perusal of the reports in our columns will show. It is, however, useless to pursue this point, because it raises the whole question of whether dealers in a falling market are at liberty to call the price what they like, whether business passes or not. It may be definitely asserted that so far as two-thirds of the London market is concerned, 17s. 6d. was not the value for the month of November; it would be more like 19s. 6d. net.—Ed. J.G.L.]

Naphthalene.

Sir,—Numerically, probably it is safe to say that the majority of gas-works are not in a position to employ high-temperature steam for vaporizing petroleum; while a very large number of small works use gas-engines, and no steam at all.

What process and vaporizing spirit are recommended for such as these?

Dec. 18, 1915. T. W.

Pooling of Railway Waggons.

Sir,—Mr. Ferguson Bell's letter comes none too soon; for it seems that the Board of Trade intend to move swiftly in the matter of the pooling of waggons.

If Mr. Bell fears for the larger gas companies, what chance have the the smaller ones to maintain a supply of coal? The loss or delay of even a couple of waggons may spell disaster.

The arguments in favour of the scheme—that much haulage of empty waggons and much labour in shunting and marshalling would be saved—are quite valid; but it should not be beyond the wit of the Board of Trade to devise some scheme whereby empty waggons could be utilized on their route, without pooling all waggons and scattering them all over the country. An empty waggon going (say) from London to Yorkshire might be used for conveying goods destined for some point which that particular waggon would pass. No one, I think, would object to this; for the waggon would be kept on its own route, and would lose little time (if any) on its return journey.

But to pool all waggons, irrespective of ownership, seems to me to partake of the character of the labour of the mountain to produce the mouse. To gain little, you are going to upset much.

10, *Arthur Street West, E.C., Dec.* 17, 1915. H. L. JOHNSON.

Training for the Gas Profession.

Sir,—Mr. Thomas Glover, in his letter to you of Nov. 2, gives some valuable general advice on the training of the gas engineer, endorsing Mr. Fulton's views recently set forth in your columns; but as more definite and detailed suggestions might be required by some of those about to enter upon a gas engineering career, I venture to make the following remarks.

An assistant of mine who was formerly a member of the Manchester Junior Gas Association has placed in my hands a copy of the Calendar of the Manchester School of Technology, in which there is given a detailed course of "Gas Engineering." I was not aware that such a course existed; and I offer my heartiest congratulations, as a former President of the Scottish Junior Gas Association (Western District), to the Manchester District Junior Gas Association, to whom I believe the inception of this course is due. Of excellent pieces of work done by the Junior Associations, this scheme must rank among the best—not that it can be regarded as faultless; but it is a definite and clear attempt at systematizing training.

The classes are organized to form progressive courses of training and lead to the associateship of the school, with free admission to further approved courses in the school. The courses involve attendance on three evenings a week during four evening class sessions of about thirty weeks each, and four evenings per week during the fifth session of thirty weeks. Examinations are held at the end of each session; and only those students who satisfy the examiners are allowed to proceed to the following year of the course.

As will be seen from the detailed syllabus, the fundamental subjects—mathematics, physics, and chemistry—are taken first; and if these be thoroughly well grasped, the student will find no difficulty in following out the rest of the course with advantage to himself and the gas industry generally. For many students it will not be possible to attend technical schools such as there are at Manchester, Birmingham, Glasgow, &c.; and for these it could be arranged that they should follow out the syllabus as far as possible at their local technical schools and by self-tuition, and then be allowed to present themselves as external students for the examinations that are held at the schools where the group course was carried out.

I am laying this scheme before Professor Gray, of the Royal Technical College, Glasgow, and hope it may be adopted by the college. All the classes are, of course, in existence; and it merely means the granting of the necessary diploma when the course is completed.

There is another point which might be mentioned. When a student has gone through this course, and taken the course certificate, I would suggest that, on producing evidence to the Institution of Gas Engineers that he has held a position as an assistant in a gas-works for (say) two years, this body should grant him a degree of Associate Member of the Institution of Gas Engineers, with the right to letters to be agreed on after his name. "A.M.I.G.E." might do.

The course is as follows; but I would suggest that "Building Construction" might be profitably replaced by "Prime Movers," or some similar class.

Greenock, Dec. 7, 1915. JAMES MACLEOD.

[Enclosure.]

Gas Manufacture—Diploma Course.

FIRST YEAR.

Chemistry of the non-metals	1	hour per week
Inorganic chemistry—laboratory	1½	,, ,,
Practical mathematics—Stage I.	2	,, ,,
Physics for chemists	1	,, ,,
Physics—laboratory	1½	,, ,,

Three evenings per week.

SYLLABUSES OF ABOVE CLASSES.

Chemistry of the Non-Metals—Lectures.—Preparation and properties of the halogens, and their principal compounds. Laws of chemical combination, atoms, and molecules. Avogadro's theory; methods of determining atomic and molecular weights; dissociation; classification of elements; the periodic law. Boyle's law and Charles' law. Manufacture of oxygen; methods for determining the composition of air and water, Hydrogen peroxide; ozone, boron, and silicon, and their compounds; glass and porcelain. Phosphorus, arsenic, antimony, and bismuth, and their chief compounds.

Inorganic Chemistry—Laboratory.—Study of the properties and compounds of the halogens and the phosphorus group of elements. Determination of equivalents of elements. Simple analysis.

Practical Mathematics—Stage I.—Methods of approximate calculation, arithmetical, logarithmetic, and slide rule; application to mensuration of plane figures and solids. Trigonometrical functions; solution of right-angled triangles. Factors, algebraic fractions; simple and quadratic equations; problems; easy indices and surds. Plotting of algebraic functions; easy cases of graphic solution of equations; the law $y = a + bx$ obtained from plotted results of experiments.

Physics for Chemists—Lectures.—Units and measurements; physical balance; density, capillarity, viscosity; properties of solutions; physical properties of gases. Light; index of refraction; the spectrometer; the spectroscope; the microscope; the polarization of light, heat; temperature measurements; calorimetry, vapour pressure; hygrometry; radiant heat. Electricity; units; Joule's law; electrochemistry; electromagnetism; electrical measurement; thermo electricity.

Physics for Chemists—Laboratory.—Testing of the physical balance; calibration of measuring instruments; determination of density; surface tension; viscosity; thermometry; pyrometry; calorimetry, expansion by heat; melting-points; boiling-points, hygrometry; optical measurements; use of the spectrometer and spectroscope; polarization of light; electrical measurement; electrochemical experiments and measurements.

SECOND YEAR COURSE.

Chemistry of the metals—lectures	1	hour per week
Inorganic chemistry—laboratory	1½	,, ,,
Organic chemistry—Stage I., lectures	1	,, ,,
,, ,, laboratory	1½	,, ,,
Machine construction and drawing	2	,, ,,

Three evenings per week.

SYLLABUSES OF ABOVE CLASSES.

Chemistry of the Metals—Lectures.—General properties of the metals, methods of extraction and principal properties of the more important netals. Preparation, properties, and uses of their chief compounds. ntroduction to the study of thermo chemistry and electrolysis.

Inorganic Chemistry—Laboratory—The quantitative analysis of simple alts and mixtures. Volumetric analysis.

Organic Chemistry—Lectures.—The hydrocarbons of the fatty or aliphatic series and their derivations.

Organic Chemistry—Laboratory.—Practical work in connection with he lectures.

Machine Construction and Drawing.—Mechanical drawing, principles nderlying the arrangement, proportions and strengths of simple nachine details. Freehand sketches from models, drawing to scale nd principles of projection. Use of sections, bolts, studs, and setcrews; forms and proportions of nut and bolt heads, proportion of iveted joints, use of split pins; connection of parts by keys and otters, forms of pipe and cylinder flanges; forms of shafting and ules for strength of couplings; pedestal and plummer blocks; hanging rackets, pulleys and speed cones; cranks and link work; different orms of connecting rod ends; eccentrics; pistons, stuffing-boxes, and lands; valves of various kinds.

THIRD YEAR COURSE.

Chemistry of gas manufacture—Stage I.	1	hour per	week
Gas engineering—Stage I.	1	,,	,,
Gas engineering calculations	1	,,	,,
Applied mechanics—Stage I.	1	,,	,,
*Applied Mechanics—laboratory	2	,,	,,
Building construction—Stage I.	2	,,	,,

Three evenings per week.

* This class is taken during the summer session.

SYLLABUSES OF ABOVE CLASSES.

Chemistry of Gas Manufacture I.—Lectures.—The construction of gasretorts; the construction of retort-furnaces; the effect of temperature n modifying the quantity and quality of gas produced; the description of apparatus employed for the conveyance of the gas immediately upon ts leaving the retorts; apparatus for cooling the gas, and for removing he products of condensation; the methods of removing the gaseous mpurities from the cooled gas, and the most suitable condition of the gas for effective purification. The use of an exhauster. Control of pressure at the works. Chemical and physical examination of gas.

Gas Engineering I.—Lectures.—Design, construction, and working of gas-works plant; retort-settings; construction, setting, details, economical designs. Coal and coke handling plants, condensers, washers, washer-scrubbers, tar-extractors, exhausters, purifiers, meters, gasholders, station-governors, &c.

Gas Engineering Calculations—Lectures.—Measurement of pressure in terms of inches of water; pressure in and upon tanks. Capacities and strengths of gasholders. Low and high pressure gas in mains; structural and miscellaneous work. Illumination problems.

Applied Mechanics I.—Lectures.—Graphic representation of forces and velocities; diagrams of work; moments and couples; levers; simple machines illustrating mechanical advantage; velocity ratio and efficiency; the laws of friction; lubrication; transmission of power by shafting, wheel gearing, pulleys, belts, and ropes; laws of motion; angular velocity; acceleration; kinetic and potential energy; centrifugal force; impulse and momentum, elementary hydrostatics; laws of fluid pressure; accumulators, packing presses.

Mechanics Laboratory.—Triangle and polygon of forces; moments; sliding friction; belt friction; test of a simple machine for velocity ratio, mechanical advantage, and efficiency; energy in a fly-wheel.

Building Construction.—The application of descriptive geometry. The preparation to scale of working drawings of elementary details of construction. The construction and description of methods of procedure in brickwork, stonework, lead work, slater's work, ironwork, plasterer's work, woodwork. The nature and properties of materials.

FOURTH YEAR COURSE.

Chemistry of Gas Manufacture II.	1	hour	per	week
Short course on special subjects	1	,,	,,	,,
Gas engineering II.	1	,,	,,	,,
Gas analysis	2½	,,	,,	,,
Gas supply I.	1	,,	,,	,,

Three evenings per week.

SYLLABUSES OF ABOVE CLASSES.

Chemistry of Gas Manufacture II.—Lectures.—Selected subjects of the third year course treated in greater detail, recent researches in the chemistry of gas manufacture.

Gas Engineering II.—Lectures.—Vertical and chamber settings; modern apparatus; management; structural capacity and costs; flow of gas in mains. Gas in competition for light, heat, and power.

Gas Analysis—Laboratory.—The common analyses; calcium in lime; silica in fire-bricks; bog ore, &c. Proximate analysis of coals and cokes. Valuation of ammoniacal liquor. Ammonium sulphate; assay of tar; spent oxide. Determination of sulphur, cyanides, &c. Calorific values of coal and coal gas; impurities in coal gas. Manipulation of the apparatus used in the analysis of gases. Special methods for individual constituents.

Gas Supply—Lectures.—Law relating to the supply of gas. Station and district governors, objects and construction. Principles of gas distribution, mains, and services. Unaccounted-for gas. Tools and appliances used in gas supply; principle and construction of wet and dry meters, inferior fittings, general lighting.

FIFTH YEAR COURSE.

Gas supply II.	1	hour per	week
Special gas analysis	2½	,,	,,
Gas-engines	1	,,	,,
Physical chemistry	1	,,	,,
Physical chemistry—laboratory	2½	,,	,,

Four evenings per week.

SYLLABUSES OF ABOVE CLASSES.

Gas Supply II.—Certain subjects in the fourth year course treated in greater detail. Proportion and sizes of mains for the area to be supplied, causes of leakages, corrosion of mains, cast iron and steel mains, pressure registers, high-pressure lighting, gas for heating and power purposes.

Special Gas Analysis—Laboratory (Meets Fifteen Evenings, Beginning September).—Further development of the subjects dealt with in the fourth year course, together with chemical analysis, and a study of the tests used in gas-works.

Gas-Engines.—Construction of gas-engines; the Otto cycle; thermodynamic considerations; economic comparison of gas-engines, Diesel engines, and steam-turbines.

Physical Chemistry—Lectures.—The molecular and atomic hypotheses; kinetic theory; liquefaction of gases; solutions; the factors which influence the velocity of chemical action, chemical equilibrium; the phase rule and some of its applications; thermo-chemistry, the radioactive elements.

Physical Chemistry—Laboratory.—Methods of determining the densities of gases, vapours, liquids, and solids. Construction and use of thermostats. Determination of solubility. Refractive indices; use of the Pulfrich, crystal Zeiss, and other refractometers; polarimetric measurements, the spectroscope and spectrometer; cryoscopic and ebullioscopic determinations of molecular weights; viscosity and surface tension determinations; diffusion of gases.

REGISTER OF PATENTS.

Manufacturing Incandescent Gas-Mantles.

MULLER, J. L., of Sannois, Seine-et-Oise, and BONNET, J., of Paris.

No. 683; Jan. 15, 1915. Convention date, Jan. 31, 1914.

In the machine for firing, incinerating, and calcining mantles for incandescent gas lighting, covered by patent No. 6556 of 1909, movement is imparted to the machine by chains placed on the right and left of the machine. These chains move, under the thrust of a special device, on pulleys secured to the two ends of the machine. and are at times rendered idle by automatic stopping devices, so as to enable the various gas-pipes to fire, incinerate, and calcine the mantles. In their movement of translation, the chains operate mantle-supporting rods and mantle-guiding rods, the ends of which penetrate and move in upper guides in their displacement towards the front of the machine, and in lower guides in their displacement towards the rear of the machine when the supporting rods are each provided with a series of mantles. The device forming the subject of the present invention obviates certain drawbacks which have been discovered in the earlier arrangement.

The device consists essentially in replacing the elevator driving chains by rigid members intended to bring the ends of the mantle-carrying rods and mantle-guiding rods exactly into the position that the rods should occupy in the upper or lower guides. It comprises, moreover, certain members actuated by the cam rod, and intended to place and maintain the mantle supporting and guiding rods above each of the treble gas-pipes. And, finally, it comprises means for stopping the cam rod so as to avoid its retractive movement during any of the operations of the machine, either by the action of a spring or any other cause.

Valve-Mechanism of Gas-Engines.

GILL, W. A., of Portland, Oregon, U.S.A.

No. 892; Jan. 19, 1915.

This invention especially relates to the valve mechanism of four-cycle gas-engines; and one of the main objects of it is to provide a valve which will remain fluid-tight in service, without depending on packing rings.

This object is sought to be attained by the combination of a cylindrical valve chamber and a hollow rotary valve therein, made of a plurality (preferably two) of segmental sections having longitudinal abutting faces. The interior of the valve is in direct communication with the combustion chamber and forms part of it; and the driving fluid is conducted through the valve—thus utilizing the pressure of the fluid in the valve as a means for holding the valve parts in gas-tight relation with the valve-seat in the chamber. The opposed faces of the valve parts in the seat will thus maintain each other true, though worn away in service. The axis of the valve is approximately co-incident with the axis of the combustion chamber.

An incidental object of the invention is to so construct the valve that it may be easily and quickly removed from the cylinder; and, furthermore, the intake and exhaust ports are made in duplex.

Valves for Controlling the Flow of Fluids.

GILMAN, F., of Birmingham, and CLEMENTS, G. F., of Smethwick.

No. 5683; April 15, 1915.

This invention has particular reference to valves for controlling the flow of compressed air to pneumatic tools and machines and the supply of air and gas to blow-pipes or burners for heating purposes.

The body of the valve is circular, with an approximately V-shaped groove turned round it; and fitting in the groove is a ring preferably divided cross-wise at one or more parts and having inclined annular faces adapted to fit against the corresponding faces of the groove. The ring is embraced by an external spring band or other device to maintain the inclined faces in close contact with the inclined circular faces of the body. The valve is provided with passages extending from one inclined annular face to the other, and in the corresponding inclined faces of the body are inlet and outlet passages corresponding with the passages through the ring valve. Thus when the ring valve is turned to such a position that its passages coincide with the passages in the body, there is a through passage through the latter and through the ring valve for the fluid—a passage that can be controlled or stopped by turning the ring valve in a greater or less degree.

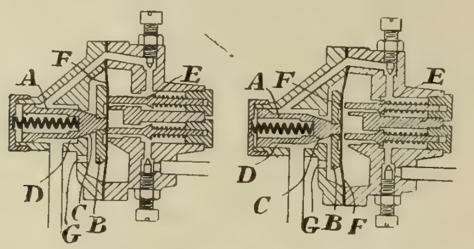
Automatically Lighting and Extinguishing Gas-Lamps.

Keith, J. & G., of Farringdon Avenue, E.C.

No. 6395; April 29, 1915.

This automatic lighting and extinguishing apparatus for high-pressure gas-lamps (as described in patent No. 4290 of 1914) has for its primary object to provide means for preventing gas which has leaked past the valve controlling the pilot light bye-pass from passing to the pilot tube while the lamp is alight—thereby preventing deposition of carbon in the pilot tube—by providing a passage which is out of communication with the gas supply when the pilot light is in use, but is adapted to permit escape to the atmosphere of any gaseous leakage entering the pilot supply while the lamp is alight.

Vertical sections are given of one embodiment of the invention, showing the main valve in the closed and open positions respectively.



Keith's Lamp Lighter and Extinguisher.

The spindle A of the plunger B, in lieu of being guided along its entire length as before, has a sliding fit with the outer end only of the spindle guide, and at its inner end is tapered to form a conical valve portion C adapted, when the plunger is in its innermost position—corresponding to the closed position of the main valve—to seat-on the contracted inner end of the guide, so as to afford between the spindle guide and the spindle an annular space D, which is maintained closed at the outer end but which is open at the inner end during such time as the portion C is unseated.

Leading to the space D is a passage extending through the cap of the diaphragm casing into the casing proper and communicating with the pilot light supply.

In the outward position of the plunger—corresponding to the open position of the main valve, and to the interruption of the supply to the pilot light by the pilot supply control valve E—the space D is brought into communication with the chamber formed in the cap at the back of the diaphragm F, which chamber is formed with a small vent G open to the atmosphere. Accordingly, any leakage of gas past the valve E and through the passage to the annular space D can now pass, by way of the vent, to the atmosphere.

With the spindle A guided in a comparatively narrow bearing, in lieu of being in a bearing for substantially its entire length, it is pointed out that friction due to the eccentricity thereto of the pilot supply control valve and of the enriching supply control valve is diminished, inasmuch as, although these valves tend to tilt the plunger and spindle, the extent of the tilting movement is limited by reason of the plunger being held in central position by its frictional engagement with the diaphragm. Moreover, in the event of the plunger being displaced from its central position when retracted, it will be restored to the central position by the engagement of the conical valve portion with its seat.

Removing and Loading a Mass of Coke on a Quenching Bench.

Carl Still (firm of), of Recklinghausen, Germany.

No. 8609; June 10, 1915. Convention date, June 26, 1914.

This invention relates to the removal and loading of the quenched masses of coke lying on the bench by the aid of a mechanically operated scraper, which pushes the coke (in a coherent mass) over the floor of the bench and towards a loading ramp—the coke at the same time being caused to pass over a grating, which separates the small from the large coke. It is a modification of the arrangement described in patent No. 7364 of 1915.

The feature, according to the present invention, is the employment of a grating in which the width of the gaps running at right angles to the longitudinal axis of the bench increases progressively on the superficial plane of the grating in the transverse direction of the grating in such a way that the mass of coke to be pushed over the grating is obliged to pass over the narrowest portion of the gaps first and then over the progressively widening portions. This effectually prevents any jamming of fragments of small coke in the gaps of the grating (which would inevitably cause the free spaces in the grating to choke-up completely in time) since any fragments of coke lodging in the gaps are forced onward by the advancing coke into the wider portions of the gaps and thus released, so that they can drop freely down. A special form of the bars for the grating in question is also described.

Removing and Loading a Mass of Coke on a Quenching Bench.

Carl Still (firm of), of Recklinghausen, Germany.

No. 8705; June 12, 1915. Convention date, Nov. 16, 1914.

This invention is another modification of that described in patent No. 7364 of 1915.

The earlier invention includes the use of a coke-quenching bench in which the removal and loading of the coke lying on it may be effected by a mechanically operated scraper in the form of a beam movin directly over the floor of the bench and pushing the coke, in an irregu lar form, as a compact body directly over the floor of the bench, so to cause it to pass over a grating "which separates from the moving cok the useless small coke which lowers its value."

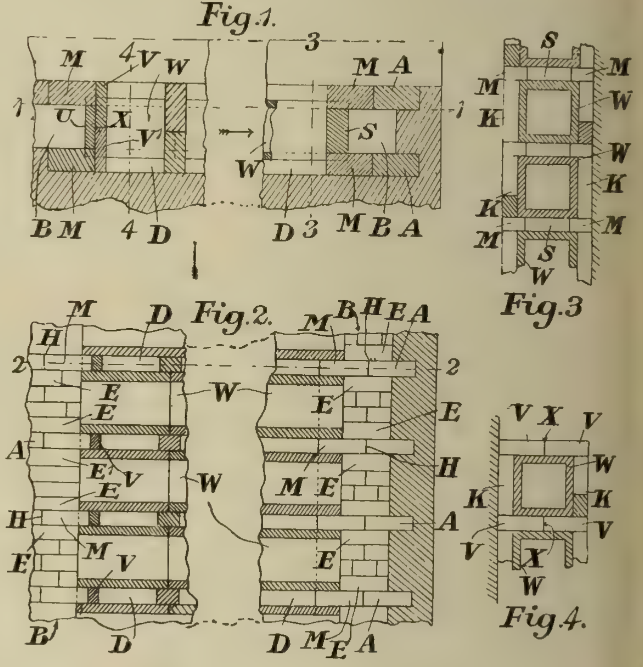
The object of the present invention is to complete the separation the small coke by the screen, by employing a grating formed of tw plane surfaces which abut together at an obtuse angle along a long tudinal edge of the quenching bench, and are arranged in such a wa that, in its passage over the grating, the heap of coke is obliged first t travel over a substantially horizontal portion of the grated surface, and immediately afterwards, over a sloping portion of it.

Regenerative Furnaces.

Drakes Limited, and Drake, W. A., of Halifax.

No. 9214; June 23, 1915.

This invention relates to regenerative retort furnaces, wherein th waste gases from the combustion chamber surrounding the retorts ar conducted first in a downward direction and then forwards throug horizontal flues to finally escape by the chimney—the horizontal flue being formed of tubes so arranged that the flues for the secondary ai surround them in the usual manner. It has heretofore been customar to construct the vertical inlet and outlet flues leading to and fro the horizontal flues by arranging to have partitioning pieces which secure the outer walls of the structure to the interior tubes; but the present proposal is to have the vertical flues free from partitioning pieces, and secure the binding of the outer walls of the structure by so forming the brickwork at the ends of the tubes that the desired result is attained without the vertical passages being interrupted.



Drakes' Regenerative Retort-Furnace.

Fig. 1 is a sectional plan taken on the line 2 of fig. 2, showing sufficient of the outer walls and inner flues of a regenerator to illustrate the invention. Fig. 2 is a vertical sectional elevation taken on the line 1 of fig. 1, as seen in the direction of the arrow. Fig. 3 is a sectional end elevation taken on the line 3 of fig. 1 in the direction of the arrow. Fig. 4 is a similar elevation taken on the line 4, as seen in the direction opposite to that indicated by the arrow.

To attain the object of the invention (preferably by the employment of bricks of common or ordinary shapes or dimensions) the patentees arrange the brick walls adjacent to the outer ends of the horizontal flues, to receive bricks A that will reach from the walls to extend alongside the flues B, so that other bricks M may reach from contact with them to extend over, and rest upon, the outer ends of the tubes W. Upon and beneath these pairs of bricks in each course are placed other bricks E, which cross the joints H, so that, when the walls are completed, the ends of the tubes W are firmly bound to them. Between any two bricks M in connection with each tube W is placed an intervening brick S, which forms part of one of the side walls of the secondary air flue D; while the remainder of the side walls are formed by bricks K.

This arrangement of the bricks may be made use of where it is not of great importance to have the joints between them thoroughly protected against leakage from the flues B or D. But when such leakage has to be completely prevented, a modification in the arrangement is made whereby the bricks which rest upon the portion of the tube W are arranged to extend into the walls of the structure, so that other bricks may be walled on them, as at the left side of fig. 2. A brick U, of ordinary size (except that it is only of half width—a "soap"), is mounted between two bricks, while two other bricks V, also of half width, are walled behind the brick U and against the ends of the bricks, thus forming one of the inner side walls of the flue D. These two bricks cross the joints at the ends of the brick U, and therefore render the joints perfectly air and gas tight; while the joints X, formed at the ends of the bricks, are stopped or protected by the brick U, preventing leakage in this direction.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Reduction in the Power of Gas.

Mr. Will Thorne asked the Minister of Munitions if he was aware that ie War Office had notified local authorities that, owing to the demand or benzol and toluol for the manufacture of explosives, it had been ound necessary to require gas undertakings throughout the kingdom) extract these constituents from their gas, thereby in some cases ffecting the illuminating power of the gas and its calorific power; if e was aware that the War Office had advised that the general public ould do everything in their power to prevent attacks on gas under-ıkings owing to the possible deterioration of the gas supply, and that iis could best be done by ceasing to test gas altogether, or by prevent-ıg results of the test being made public; if he was aware that some few ears ago the illuminating power of gas was reduced; that if the gas ests were abolished by local authorities a greater amount of impurities vould pass through the gas-mains; if he was aware that if the calorific ower was reduced it would mean that more gas would have to be onsumed for heating and cooking purposes at the cost of the general onsumer; and if he intended taking action in the matter.

Mr. Lloyd George replied that the requirement referred to was ecessitated by paramount interests of national defence. He was ad-ised that the effect on the calorific power of gas would be inappre-iable; and in view of the greatly increased use of incandescent urners, the effect on illumination would also be restricted. The con-itions under which the gas companies have undertaken the operation t the urgent request of the Ministry were not such as to yield them ny profit, so that he hoped the appeal made to the public authorities ot to attribute blame to the gas companies for any slight inconvenience hat may be caused to consumers might have general support.

Sulphate of Ammonia.

Replying to a question by Mr. Ginnell, as to the total quantity and alue of sulphate of ammonia imported into the United Kingdom in 913, Mr. Runciman said the imports were not separately distinguished ı the official returns; but he was informed that in 1913 they did not xceed 100 tons.

Mr. Bridgeman, in answer to Mr. Mount, who desired to know the mounts of sulphate of ammonia which had been exported in the last hree months, stated that the quantities were: September, 21,943 tons;)ctober, 22,951 tons; November, 30,638 tons.

Mr. Mount asked the Parliamentary Secretary to the Board of Agri-ulture whether he could extend beyond the end of December the erm during which a proportion of the sulphate of ammonia manufac-ured in Great Britain will be reserved for purchase by farmers at a naximum price, in view of the fact that many farmers do not usually uy this fertilizer till later in the season. Mr. Acland said the matter vas under consideration.

Sir J. Dewar asked the Parliamentary Secretary to the Board of \griculture whether he could now say if the Government were to be ble to extend to farmers the privilege of getting a supply of sulphate f ammonia, at a fixed price, to be applied to the land in spring, imilar to the arrangement which was made in regard to sulphate of mmonia applied to the land in November and December.

Mr. Acland said the question had been for some time under conside-ation by the Fertilizers' Committee, and he hoped shortly to be in a osition to make an announcement on the subject. The price arranged or sulphate for autumn dressings was a special one. Much must lepend, however, on the general conditions of the market after the iew year.

Chemical Manures.

Mr. Ffrench asked the amount of nitroleum, nitrate of soda, nitrate f lime, and sulphate of ammonia available in these kingdoms for gricultural purposes, and the price per ton at which these commodities ould be respectively sold.

Mr. Acland replied that the information obtained by the Board of \griculture as to the stocks of artificial fertilizers was supplied for fficial purposes only, and on the understanding that it would not be ublished. The prices of artificial fertilizers varied considerably at lifferent centres and were subject to numerous qualifications which nade it difficult to give them in reply to a parliamentary question.

Lighting of the Streets.

Sir J. Simon, replying to Mr. C. Wason, said he was aware that lifficulties were experienced by women and girls in securing places in ublic conveyances between the hours of five and seven or eight. These difficulties were no doubt somewhat accentuated by the darkness, ut he was afraid that legislation to compel all shops employing female ssistants to close at five would be extremely controversial, and, even f it were passed, it would still leave women assistants during a part of he winter months to return to their homes in the dark. A movement n the direction of voluntary earlier closing had already begun; and this, he hoped, would spread.

Mr. W. Thorne asked whether there was any reason for maintaining the present lighting order in face of the present circumstances.

Sir J. Simon: Yes, Sir, I think there is.

Munitions of War (Amendment) Bill.

This Bill was considered in Committee last week; and in connection with clause 6, which deals with the "Extension of Definition of Munitions Work," it was agreed that the expression "munitions work" should include the supply of light, water, or power in cases where the Minister of Munitions certifies that such supply is of importance for the purpose of carrying on munitions work, and the erection of buildings, machinery, and plant required for such supply.

Mr. Reginald H. Palmer, who was lately with the Welsbach Light Company, Limited, has been granted a commission in the Royal Naval Motor Boat Patrol Section, and has already joined his ship.

LEGAL INTELLIGENCE.

LIGHTING CONTRACTS AND LIGHTING RESTRICTIONS.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Friday, Dec. 17.

(*Before Mr. Justice* Low.)

Leiston Gas Company, Limited, v. Leiston-cum-Sizewell Urban District Council.

This action, which raised an important question as to the liability of lighting authorities having regard to the regulations under the Defence of the Realm Act, was set down for hearing as a short cause under Order 14.

Mr. Poyser, for the defendants, asked that the trial should be postponed, as the case was not ready for trial. The question turned upon an agreement for lighting the whole of the district of Leiston; and the defendants had put in a counter claim to which plaintiffs had as yet had no opportunity of replying. If the hearing were postponed, admissions might be made which would leave no dispute as to the facts of the case; and in that event there would be no point of law to be decided as to the effect of the contract.

Mr. Rayner Goddard, for the plaintiffs, said that, in his view, there was no dispute as to the facts. The action was brought upon a contract; and the counterclaim was merely a formal claim for a declaration that the contract was not binding on the Council. The question, which was purely one of law, was whether the agreement was binding in view of the regulations under the Defence of the Realm Act as to the restriction of lighting. If any question as to damages arose, this could be referred to the Official Referee.

His Lordship asked whether plaintiffs were claiming under an agreement by the defendant Council to pay for public lighting.

Mr. Goddard said that was the nature of the case; and the short answer was that the regulations made under the Act had necessitated the lights being put out, and therefore defendants said they were not bound to pay anything.

His Lordship asked whether the Gas Company desired to make the ratepayers pay for gas which had not been consumed.

Mr. Goddard replied in the negative, and said that, when the regulations were made, the Gas Company indicated that they were prepared to meet the Council in the matter; but defendants repudiated the agreement.

His Lordship said he could quite see there might be a good point of law to be argued as to whether the contract had become impossible of performance.

Mr. Poyser remarked that it was really a claim for gas which had not been supplied.

His Lordship said the case might raise questions of far-reaching importance, and he should not try it as a "short cause." The case would stand over till next sittings, which commenced on Jan. 11; and, if possible, a day would be fixed for the hearing.

THE BASIS OF WATER-RATES.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Divisional Court—Thursday, Dec. 16.

(*Before Justices* Ridley, Avory, *and* Lush.)

Woking Water and Gas Company v. Parker.

This was an appeal on behalf of the Water Company from the decision of the Justices fixing the amount at £109, the net rateable value on which the rate for a supply of water for domestic purposes should be based, instead of £130, the gross estimated annual value, which the Company contended was the amount on which the rate should be based. A report of the proceedings at the Woking Petty Sessions was given in the "Journal" for July 13 last, p. 85.

Mr. Clavell Salter, K.C., and Mr. A. M. Paddon appeared for the appellant Company. Mr. Macmorran, K.C., and Mr. J. D. Crawford represented the respondent.

Mr. Salter said the question raised turned upon the charging section of the Company's Act of 1881, as to the rate to be charged for a supply of water for "domestic" purposes. The question was one of great importance, because it not only affected the rights of the appellant Company to make the charge for domestic purposes which it had made for the last 30 years, but it also raised, of necessity, the right of a large number of provincial water companies whose charging sections were in precisely identical terms with those of the appellants. Section 49 provided that the Company should, at the request of the owner or occupier, furnish water at rates specified in the section—"where such gross estimated annual rental shall exceed £100, at a rate not exceeding £5." The more modern form of sliding-scale was that of a percentage. But here it was based on the gross estimated annual rent; and the Company were authorized to base the charge on the gross estimated annual rental.

Mr. Justice Lush: Does it not mean that the Company may charge any sum provided it does not exceed that amount?

Mr. Salter: No doubt that is so.

Mr. Justice Ridley: Is the question whether the amount should be based on the gross estimated rental or the net annual value?

Mr. Salter: That is the point. The respondent said that because the Statute incorporated by reference the Water-Works Clauses Act, 1847, which provided that the rate should, unless the Special Act otherwise provided, be based on the annual value, and because the

House of Lords had decided, in *Dobbs v. Grand Junction Water Company*, that it was not so, you were to refer to both the Acts, and that Parliament meant to say that where, on the gross estimated rental, the rate exceeded £5, the Company were to charge, not £5 but on the annual value. The suggestion was that Parliament in its wisdom thought fit to place the charge on the gross estimated value.

Mr. Justice Avory: They say you are to apply the 5 per cent. rate in all cases where you have a house with a gross estimated rental exceeding £100.

Mr. Salter: That no doubt will be the argument on behalf of the respondent; and in reply I say that the charge is based on section 49, and that section 68 of the Act of 1847 does not apply. Even if it does apply, it says the charges are to be based according to the annual value.

Mr. Justice Ridley: It does not say "payable on the annual value," but "according to the annual value."

Mr. Salter said it would be impossible for the Court in dealing with a matter of this kind, and construing the Statute, not to look at other cases; and his submission was that it would be a perfectly unheard of thing not to sanction the charge which the particular company were authorized to make. It would be a most unfair thing if, after all these years, it could now be said that the effect of Dobbs's case was that, wherever the Act of 1847 was incorporated, the charge was to be based on the net, and not on the gross, value. The case of *South Staffordshire Water Company v. Barrow*, whose charging section was in the same terms as the Woking Company's, had decided that the charge should be based on the estimated gross annual value. It was a popular delusion that it was better for the consumer that the rate should be based on the net annual value; it all depended on "how much." The majority of the Acts passed in 1881 were in the same elliptical form. In 1887, the district of the appellant Company was extended by the acquisition of the Farnborough Company; and section 59 of the Act provided that the Company should supply "according to the rateable value, and where the rateable value exceeded £100, at a rate not exceeding £6." The same elliptical expression was used in that Act. Here the respondent paid £6 10s.; and if he were in the added district he would pay the same sum.

Mr. Macmorran observed that the Act of 1887 did not apply to his district at all.

Mr. Justice Avory: Do you say 6 per cent. on the rateable value is equivalent to 5 per cent. on the gross estimated annual value?

Mr. Salter: Yes. If the argument for the respondent was right, the consumers in the added area were paying too much, which surely could not have been the intention of Parliament. In the Act of the Clacton Water Company there was a sliding-scale up to a certain amount giving an ascertained sum, and not a percentage. It went up to £95, where one had to pay 120s., and where it exceeded £100 "at a rate per cent. not exceeding £5." The question was as short as it was plain; but it was a most important one. His submission was that the Magistrates had been in error in deciding that the rate should be at the lower rent. The special case found that the gross estimated annual value was £130 and the rateable value £109; and the question was whether the respondent was to pay on £109 or £107.

Mr. Macmorran said he had looked at every decided case under section 68 of the Act, but could find no authority on the point, which, it appeared, had never been raised before. For the Company, it was said the point was plainly in their favour; but he (Mr. Macmorran) submitted it was equally plain the other way, and must be decided according to what the Legislature had said, and not according to what it was presumed they meant to say. What the Legislature had said was this: "In the General Act of Parliament dealing with water-rates you are to calculate according to the rateable value of the premises supplied." Annual value had been thought to mean the gross; but this was rudely set aside by the House of Lords in Dobbs's case. In the Woking Act there was a proviso that the Act of 1847 was incorporated, except where expressly varied by the Act. Therefore section 68 applied; and one had to look to see whether there was an express variation. The suggested variation was said to be found in section 49. That section did not, however, vary the other, it merely supplied a scale upon which the water-rate was to be charged; but it left the charge to be calculated upon the annual value—a percentage of so much on the annual value as laid down in section 68. This gave full effect to both sections. Appellants must read into section 49 words which were not there in order to give effect to their contention—words such as these, "at a rate on such gross estimated annual value." One could not look at other Statutes containing these words in order to construe section 49. In many Acts the rate was calculated on the "annual rack-rent" or "value," which was different from "annual value." In *Stephens v. Barnet Gas and Water Company* both the expressions were used; and the Court held that "annual value" was the same as "annual rack value." He did not say that "annual value" must in every case signify "net annual value."

Mr. Justice Lush said the Court had only to construe the words of section 49.

Mr. Macmorran submitted that section 49 did not vary section 69. The Legislature had left altogether untouched the provision in the General Act that the rate was to be calculated on the annual value.

Mr. Justice Avory: If you look at the body of section 49, you say a consumer is entitled to demand a supply of water, and that it shall be furnished for domestic purposes "at rates upon the annual value not exceeding the sums following."

Mr. Macmorran: Yes, that is the effect of the incorporation of section 68. Where the gross estimated rental exceeded so much, the rate was to be at so much per cent. But it was on the annual value; whereas appellants sought to read in words which they were not justified in doing.

Mr. Justice Avory: May your point be put shortly in this way: Looking at the section which incorporates the Water-Works Clauses Act, except where expressly varied, you say section 49 does not expressly vary the enactment by which the rate is to be based on the annual value?

Mr. Macmorran: Quite so. I submit that section 49 means exactly what it says, and nothing more. No doubt the case was of importance to water companies, but it was also of importance to consumers.

Judgment.

Mr. Justice Ridley said he had come to the conclusion that the decision of the Justices could not be supported. They had said the rate was to be levied, and payable, on £109, which was the "ne annual value," and not on £130, which was the "gross annual value." The question was not a very easy one to answer. The words were capable of receiving the construction contended for by Mr. Macmorran, but he thought it was not so satisfactory a construction as that for which Mr. Salter contended, especially considering the case of *South Staffordshire Water Company v. Barrow*. The difficulty arose in this way: Section 49, that providing the rate at which water was to be supplied for domestic purposes, said it was to be laid on at the application of any person entitled to demand a supply for domestic purposes at rates not exceeding the yearly rents specified. Where the gross estimated value shall not exceed so much, at a rate per annum not exceeding £7 10s. Then there was a scale of charges, and then followed these words, "Where the gross estimated annual rental shall exceed £100 at a rate per annum not exceeding £5." There was nowhere to be found in the section a specific and direct enactment on what the rate was to be charged. This said: "A rate per cent. per annum;" but it did not say upon what. It did not say by implication that it was to be upon the gross estimated annual rental, as there was nothing else mentioned upon which it could be. Where one had a section of this kind, the intention must be that the rate per cent. was upon the only thing mentioned—viz., the gross estimated annual rental. It would have been more true to say this was an express and specific provision within section 2 if it had said in so many words the rate should be upon the gross annual rental; but it did not say this. He thought this was the meaning of the section, and the meaning it was intended to have, because at the time the Act was passed the decision in *Dobbs v. Grand Junction Water-Works* had not been arrived at by the House of Lords; and the Act of 1847, if it had been thought of at all, would have led the Legislature to the conclusion that they were putting the rate per cent. on the gross estimated rental. According to the best way he could read the section, it must have had some intention of directing on what the rate was to be; and he could see nothing else on which it could be. In the case of *South Staffordshire Water Company v. Barrow*, strong reasoning was found in favour of what he had said—that this was the right meaning. Therefore he thought that the rate in the present case should be put on the gross estimated rental, and that the words of the Act of 1847 could not prevail against the provisions of section 49.

Mr. Justice Avory, in concurring, said it was a very difficult point to decide, and but for the decision of the Court of Appeal in the case of *South Staffordshire Water Company v. Barrow*, the argument would have been equally balanced. The difficulty he had felt in the case was as to whether there was in section 49 anything sufficiently clear to amount to an express variation of the provisions of section 48 of the Act of 1847. It was clear that section 49 of the Act of 1881 might be read in this way: The Company shall, at the request of the owner or occupier, furnish a sufficient supply of water for domestic use at rates payable according to the annual value of the tenement, not exceeding the yearly rate hereinafter specified—viz., where the gross estimated rental shall not exceed so much, then at a rate of so much. This would be a way of reading section 49 as incorporating section 68 and doing no violence to the language of section 49. On the other hand, he agreed that section 49 might be read in the manner in which his learned brother had already read it—viz., as meaning that the rates were to be calculated at so much per cent. on the gross estimated rental. It was quite clear the words were capable of being read in this sense. It was not a safe guide always to say that a decision was an authority because a point had not been taken in it—in many cases it might depend on the industry of the Counsel engaged in the case; but at the same time he could not help thinking that Dobbs's case never could have proceeded through its argument, as it did, without some reference having been made to the Act of 1847. If any assistance could have been gained by reference to that Act, he could not help thinking it would have been referred to. The words of section 49 were that where the gross rental did not exceed so much, the rate per cent. was to be a rate not exceeding so much; and then the rate was to be calculated upon the preceding rental whatever it was, whether gross or annual, as the case might be. For this reason, he concurred in the judgment allowing the appeal.

Mr. Justice Lush thought, on the true construction of section 49, that the Legislature intended the rate should be on the gross estimated annual value. The appeal would be allowed with costs.

On the application of Mr. Macmorran, leave was given to appeal further.

Seizure of Gas-Mantles.

Before Sheriff Orr, in the Edinburgh Sheriff Court last week, proof was led in a petition by the Collector of Customs and Excise at Leith asking that Claude Isaac Michaelson, manufacturer's agent, of No. 5, Arden Street, Edinburgh, should show reason why he should receive cases of gas-mantles which had been seized at Leith on Oct. 7, in respect that they were imported into the United Kingdom contrary to the Customs (War Powers) Act, 1915. Alexander Calder, the Customs and Excise officer at Leith, spoke to ten cases of incandescent mantles arriving at Leith on the steamship "Mascot" from Amsterdam. The cases were consigned from a firm bearing the name of Schuyt at Amsterdam. The name did not appear on the list of approved manufacturers, and, accordingly, witness reported the facts to the Board of Customs and Excise. Subsequently he was instructed to seize the ten cases of mantles, and draw samples from one of them. Benjamin Bark, Works Manager to the Welsbach Light Company, said there was something characteristic about the German mantle which showed to an expert that it was of German make. He had examined the sample mantle (produced), and formed the opinion that it was a German-made mantle. He was led to this conclusion by the appearance of the ramie yarn, the style of the knitting of the yarn, and the appearance of the "spider," which was darned in the German way. It had been darned by a Cone's darning machine, which was used in Germany. He did not know that it was used in Holland. The mantle ring bore the mark of

Berlin firm. He thought that both the material and workmanship f the mantle were German from beginning to end. Claude Isaac lichaelson said that along with the goods he had received a certificate ating that they had been made in a factory in Holland. He thought iis was sufficient. He had also sent a letter to the makers asking if ney were really made in Holland, and he had had a reply to the effect iat they were. The case was adjourned till Jan. 17 for the examina-on of two witnesses from Holland.

An Irish Gas Manager's Action.

In the King's Bench Division, Dublin, before Mr. Justice Gibson and Ir. Justice Kenny, an application was made to have remitted to the ounty Court for trial an action by Mr. Thomas Connell, against the rim Urban Council, for alleged wrongful dismissal from the position f Gas Manager, which he had held for many years, at 25s. per week. le had been, Counsel stated, and still was, Town Surveyor, at £32 a ear. The gas-works were losing money, and he had the option of re-gning, but declined to do so; and defendants then passed a resolu-on of dismissal. The unpleasantness between the parties arose be-ause the plaintiff had lent a chain to the police for the purpose of naking some measurements in connection with the prosecution of a nan whose premises adjoined the gas-works, and who was a member f the Council. The motion was opposed on behalf of the plaintiff; he argument being that the circumstances of dismissal were such as to reclude a man in plaintiff's limited employment from getting a similar osition. The Court granted the application.

A Pumping-Station and Stream Pollution.

Last week, the action of *Waddell v. East Worcestershire Water-Works Company* came before Justice Darling and a Special Jury. The plain-iffs, who are the owners and occupiers of farm lands at Burcot ear Bromsgrove, sought to recover damages for loss sustained by eason of the defendants' alleged wrongful acts in causing the pollution f a stream running through the plaintiffs' lands; also damages for uisance, and an injunction restraining the defendants from continuing o pollute the stream. The stream in question is a natural one; and it vas said that the defendants had, since the early part of 1913, polluted t by causing, or allowing, to be discharged into it waste water from heir pumping-station above the farm; this waste water being warm nd containing oil, grease, and other deleterious matters, which ren-lered the water unwholesome and unfit for consumption by cattle, vith the result that some had died. The defendants denied that the vater was unwholesome or unfit for consumption. They further said hey had discharged water into the stream, as they had a right to do; nd that, as owners and occupiers of reservoirs and a pumping-station t Burcot, they had for twenty years before action brought, as of right, lischarged waste-water into the stream. The acts complained of were a user by the defendants of their rights. Mr. J. B. Matthews, K.C., nd Mr. Engelbach appeared for the plaintiffs; Mr. Vachell, K.C., nd Mr. Coventry for the defendants. Evidence having been given n support of the plaintiffs' case, as also for the defendants, it was stated (on the third day of the hearing) that the parties had come to erms; but these were not mentioned, further than that a sum of noney paid into Court by the defendants, with a denial of liability, would be paid out to the plaintiffs.

Londonderry Gas Price.—The Londonderry City Gaslight Com-pany announce an increase in the price of gas of 2d. per 1000 cubic feet, from the 1st of January.

Nitric Compounds from Air.—According to the "Journal des Usines à Gaz," a company has been established at Zurich, under the title "Nitrum," and with a capitalization of 400,000 frs., for the manu-facture of nitric compounds from atmospheric nitrogen.

Municipal Economy.—Mr. Walter Long is about to issue from the Local Government Board a new circular to local authorities urging that during the war they shall cut down their expenditure to the minimum. He will suggest many economies—such as reduced lighting, less street scavenging, and so on. The Government at present have no powers, it is pointed out, to enforce local economy. They can only appeal to local authorities and to local ratepayers to see that the local authorities do their plain duty in the matter.

Electricity Supply for London.—The London County Council adjourn to-day (Tuesday) till Jan. 25; but there still stands upon the *agenda* a notice of motion dated as long ago as May 19, 1914, to the effect that "it be an instruction to the Special Committee on London Electricity Supply to bring up to the Council, within three months from the date of the passing of this resolution, a report as to the methods best calculated to place London in the most advantageous position in regard to electricity supply."

Reduced Profits of a German Gas Company.—The report for the year 1914-15 of the Berlin Gas-Works Operating Company, who control a number of small gas and water works in Germany, shows gross profits reduced to nearly one-half of their amount in 1913-14. No dividend is recommended; whereas 4 per cent. was paid in the previous year. During the portion of the financial year prior to the outbreak of war, there had been an increase of 12·7 per cent. in the output of gas over that for the corresponding period of 1913-14; but from August to the close of the financial year there was a decrease of 13·3 per cent.

Gas-Workers' Wages at Carlisle.—Many requests on behalf of employees for increased wages were before the Carlisle City Council at their last monthly meeting—among those included being the gas workers. It was stated by the Union that, if the Gas Committee were not disposed to grant the increases asked for, the men were prepared to submit the matter to an arbitrator to be appointed by the Board of Trade. The Committee had replied that, provided the employees undertook to abide by the decision of the arbitrator, they would be quite agreeable to the proposal. Mr. Buck moved that the action of the Committee be confirmed; and this was agreed to.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Ordinary General Meeting of the Company was held last Tuesday, at the London Offices, No. 7, Drapers' Gardens, Throgmorton Street, E.C.—Mr. George Alexander Touche, M.P., in the chair.

The Secretary (Mr. William Martin) read the notice convening the meeting; and the Directors' report [*ante* p. 548] and the accounts were taken as read.

A Gloomy Year.

The Chairman said the proprietors met that day in the unavoidable absence of the Chairman and the Deputy-Chairman. The Chairman (Colonel Le Roy Lewis) was in France; and, while in Paris, he had been able to render signal service to the Company. The Deputy-Chairman (Mr. Arthur Lucas), he regretted to say, had been seriously ill, and had recently undergone an operation, from which, he (Mr. Touche) was glad to be able to report, he was making rapid recovery. In these circumstances, it fell to his lot to preside at the meeting, and to present such a tale of gloom as had never, he thought, been laid before the proprietors by any of his predecessors in the chair. This dismal report which the Directors submitted was owing to circumstances arising out of the war, and quite beyond control. There was a complete and unforeseen change in the situation shortly after Colonel Le Roy Lewis addressed them a year ago.

INVESTMENTS AND DIMINISHED INCOME.

As he believed the proprietors were aware, of the total investments which stood in the balance-sheet at £969,477, the greater part—viz., £806,955—was represented by their French Union gas interests. There were certain other investments, amounting to £164,532, of which £102,254 were in gas undertakings—chiefly British, but partly Continental—and the rest in miscellaneous securities. The proprietors would thus see they were dependent on their Continental interests for their dividends and their prosperity. No dividend had been earned or received from this source during the year under review; whereas last year upwards of £56,000 dividend for this Company was earned and declared, although of the amount declared the payment of a sum of nearly £30,000 was postponed. When they met in December of last year, it was expected that the postponed dividend would be distributed some time in the first half of 1915. There was every justification for expecting it at that time. Nevertheless, as Colonel Le Roy Lewis then explained, it was considered desirable to take the precaution of carrying forward the greater part of it. Circumstances had since shown his wisdom in recommending this course, and the wisdom of the proprietors in adopting it. The Company's only source of revenue therefore during the year under review had been their miscellaneous interests. From these, they had had a revenue of £9619, against £10,685 from the same sources last year. This was a diminution of something over £1000, and was due, almost exclusively, to their investments in gas companies. These had suffered from the high cost of coal, though in some measure this had been compensated for by the better prices for residuals.

SPREADING THE INTERESTS OF THE COMPANY.

In late years, the Board had been studying to broaden the interests of the Company, on the principle of average—spreading the investments, if possible, over several countries and over different industries, in so far as capital was available for the purpose. This was the principle on which trust investment companies worked. They found that depreciation in one country or in one industry was often counterbalanced by appreciation in another country or another industry. The Directors had therefore been seeking to give this Company more of the stability of an ordinary trust. This could be done only very gradually, having regard to the way in which the capital was invested; so far as it had been done already, it had proved advantageous. The proprietors might be interested in the question of the valuation of their securities. It seemed to him, there was a no more useless pastime, in days like the present, than the valuation of a block of securities. Many of the prices were arbitrary; many of the prices were quite nominal; and no valuation that could be made while the war was going on would afford a real indication of the position. Undoubtedly there would be a heavy depreciation if they had to realize that day. Undoubtedly also the greater part of the depreciation would be found to exist in their securities in gas undertakings. After crediting the revenue received and debiting the outgoings, the balance to the credit of the profit and loss account had increased from £18,654 to £20,301. Notwithstanding this fact, it was quite impossible to declare a dividend. They were carrying forward £20,000 because this balance depended entirely on the collection of the dividend of the French Company which had been postponed, and which dividend, as the proprietors were aware, amounted to £29,967.

INCOME-TAX.

The heaviest item of expenditure was income-tax. The proprietors might naturally ask why there was a charge of £4392 for income-tax when the income was only £9619. The income-tax charge was really more than £4392; but part of it had been provided in the dividend charge, on the advice of the Auditors. This, however, did not affect the financial position; it was merely a matter of book-keeping. The reason the amount was so large was that the assessment was based on the three years' average. Thus they were still liable to pay tax on revenue earned in pre-war years. But to remove any misunderstanding, he might say they were not paying tax on the £29,967 dividends the payment of which had been postponed. An arrangement had been made under which companies were allowed to include a war year for the purpose of arriving at an average, as a special concession in cases where a company had been particularly prejudiced as a result of the war. This, of course, had been their own case. They had been greatly prejudiced as a result of the war, and they had consequently approached the authorities for further relief under this provision; for although the amount of the assessment was duly provided for in the accounts, it had not yet been paid.

THE FRENCH COMPANY.

Apart from the profit and loss account, the most striking change in the figures in the accounts was the increase in sundry creditors from £5149 to £72,990. Their chief creditor was the French Gas Company. They were creditors for £64,000. The Continental Union Company were not agents or a branch of the French Company in any formal or official sense. But in these abnormal times, as the Continental Union Company were largely interested in the prosperity of the French Company, they had naturally assisted them in every way possible. In particular, the French Company appealed to the Directors to intervene on their behalf on the difficult questions of coal supply and freights. In this connection, they had placed moneys with them to be ready to meet their payments for coal and freight in this country; and this happened to be why such a large sum stood at their credit when the balance-sheet was made up. This money was represented among assets on the other side by cash for a corresponding amount included in cash at bankers and loans, £90,965.

RUINOUS FREIGHTS.

So much for the accounts of the Continental Union Gas Company. These necessarily contained very little, and the results were unavoidably poor, as their chief asset had been wholly unproductive. It was in connection with the affairs on the Continent that the year had been one of extraordinary difficulty, strenuous activity, and incessant anxiety. In the peculiar situation caused by the war, they had been compelled to step into the breach, and help their French friends in every way in their power. He could assure the proprietors the Directors had no ambition to again go through such a year as had been experienced. They had to face not only questions of bad exchange, and difficulties in international remittances, but high prices of coal and ruinous freights. Even had money been no object, there was constant difficulty in getting supplies through to Continental ports. Of all the troubles of the year, the question of freights had been the greatest. The position of freights in this country at the present time was simply chaotic; it passed the worst dream of the worst pessimist. The situation was indeed a commercial disaster of the first magnitude. He would give the experiences at the port of Genoa. The French Company had to send 360,000 tons of coal annually to Genoa. They had to forward this in addition to the coal which had to be shipped from this country to the French stations; and their requirements for the French stations during the past year had been greater than usual. They had been nearly twice as great; this was owing to inability to get French coal. It was most important that the supply should not fail; otherwise they would have had great cities like Milan and Genoa plunged into total or partial darkness.

EIGHT TIMES THE NORMAL.

Prior to the war, freights to Genoa were normally about 8s. per ton. Up to the time when Colonel Le Roy Lewis addressed the proprietors last year, the freights, although increased, were fairly reasonable, having regard to the fact that these were war times. But very soon after the meeting, a striking change took place. Freights rose to 20s. and then to 22s. 6d. before December was over. From January to March, they reached 44s.—that was, five-and-a-half times the normal. During the summer months, they went down to 25s.; but they were, as a rule, between 30s. and 35s. In September, a steady and progressive rise commenced, reaching 46s. in October, 55s. in November, and 66s. this month. The last figure was more than eight times the normal. Now consider that every increase of 20s. on 360,000 tons of coal meant £360,000. If the extra cost was 30s, it meant that the extra cost would be substantially over half-a-million sterling if this rate were continued for a year. The actual increases over normal (not the rates but the increases in the rates) had varied from 14s. 6d. in December last year to 58s. at the present time. Such rates would strain the resources of the strongest institution. He feared these ruinous freights were not due solely to the requisitioning of ships by the Government. He suspected the excess profits tax was also in some measure responsible. Shipowners were only human; and it was not very surprising if they were to try to pass some part of the tax on to the back of the already hardly-hit trader. With such charges to meet, it was no wonder the French Company found it necessary to postpone payment of the dividends declared last year. The gigantic rise in freights changed everything.

THE FALL IN PROFITS.

With these vast demands, the French Company, strong and powerful though it was, had to safeguard its financial resources at any cost of temporary inconvenience to the shareholders; and he ventured to say it was in the proprietors' interests they should do so. He felt the marvel was that they had come through so well. The profits last year, before paying interest on bonds and providing redemption, were down by over £180,000. Happily they earned enough to pay the bond interest, with a small margin, but not the full amortization of their bonds without using the substantial balance of £60,000 brought forward from the previous year. Even then there was a small debit balance. The actual reimbursement of drawn bonds was, however, postponed under the moratorium.

THE ALLEGED WASTE OF TONNAGE.

The cost of freight was not the only difficulty. On one side, they had France imploring them to intervene here, and see there was no default in the supply of coal. On the other side, they had a department of the British Government stepping in and requisitioning steamers chartered to carry the coal. The Government withdrew from the service of the French Company six steamers already chartered, and others on the point of being chartered. This might have been necessary. If necessary, it was the fortune of war; and they could not complain. He offered no criticism. Many stories were about as to the alleged waste of tonnage under Government control, while freights were getting worse and worse. One heard of ships lying idle for long periods at a time at great loss to the nation. One heard, too, of ships carrying ridiculously inadequate cargoes while traders were clamouring for tonnage. These things might have been unavoidable. In the beginning of the war, when it was impossible to say what Germany might do, it was necessary to keep large tonnage in readiness for any emergency. It was very difficult to test any individual instances of alleged waste. Merchants and shippers did not care to be involved in controversy with a public department. To hold some unfortunate member of the public responsible for a specific criticism, which, if not substantiated, was claimed as the vindication of a department, was a time-honoured method with which all politicians were familiar. But it was not a thorough way of dealing with a question of national importance.

A SUGGESTED INQUIRY.

This should be done by investigation and inquiry into the use made of the tonnage under Government control; and the materials for such a public inquiry must be available. The inquiry should be made now, and not be delayed until the end of the war. He hoped, in justice to those responsible as well as to traders and consumers, that such an inquiry would be made—an inquiry in which all the difficulties of the Transport Department (and they had been tremendous) would be impartially taken into account. In the meantime, he would not seek to prejudge the case; but he did think there was a strong case for inquiry. It was indeed a very serious question, for many traders were faced with disaster. Commercial losses were enormous, British trade was being undermined, and foreign exchanges were moving against this country, with grave consequences to the nation's financial security. In addition to the steamers requisitioned, two of the steamers were torpedoed. With the progressive increase in freights, each steamer requisitioned or lost had to be replaced by another at a higher rate of freight. Nor was this even the full measure of the cup. When ships reached their destination, a new set of difficulties began. Ports were overcrowded. Men for unloading were lacking. Waggons were also lacking. All this meant great delay in discharging cargoes; and this caused extra landing charges, demurrage, and loss on hire of steamers. There had been, on an average, 25,000 tons of coal on board the Company's vessels in the Port of Genoa for the last two months; and the waggons had been insufficient to maintain the daily consumption. The Company only obtained what was necessary in the way of waggons by seeking the intervention of the local authorities and the Government. No sooner, however, did the Company get facilities in this way than other merchants in the port began to protest; and the facilities were temporarily withdrawn, and then restored.

THE ART OF PROCRASTINATION.

What had been the reward of all this struggle? The French Company had had the privilege of supplying gas at prices much below actual cost, although certain provisions for raising prices to meet the great rise in the cost of coal were inserted in their agreements. Italy was the Ally of this country and of France, and had played such a great part in the war that he was reluctant to criticize the methods of certain Italian municipalities, even when they had as little conscience as some of our own. He would not criticize, but would only relate what had happened. Take the case of Milan. In Milan gas was cheap. If coal was above a certain cost for six months, the Company could ask the authority of the town to raise the price of gas. The matter had to be referred to three arbitrators. The war began in August, so the French Company had to wait until February before they could notify the town to appoint arbitrators. In February they gave the necessary notification. But the town obtained delays on various grounds. Delays seemed very easy in Italy. The result was that the agreement as to the terms of arbitration was not signed until Oct. 15—that was, eight months' delay, when time was everything to the French Company. The course seemed to be a simple one. It was to ascertain, from the official list at Genoa, the average price of gas coal at Genoa. To this had to be added the cost of transport to Milan, and so determine the cost at the works at Milan. It was a matter that any business man could have ascertained in a single day. The official list had been deliberately chosen because it was an independent medium.

FURTHER DELAYS.

After the belated appointment of arbitrators, the town raised further points, and advanced the theory that, in spite of the reference to the official list, the intention was to ascertain the actual cost to the Company. This would have opened up a contentious field of inquiry, and caused more delays. Allegations were made that coal was cheap to the French Company because they owned coal mines. This, of course, was pure invention. It was also suggested that the French Company could buy far below the ruling market prices, owing to their large consumption. This was pure absurdity. Meantime another six months had passed in argument. Then arbitration proceedings had to be started for the second period of six months—from February to August last—although the arbitration proceedings for the first period of six months had not been concluded. In the interval, the Company did not get their remedy and were losing money. Though the French Company were hard pressed in a gallant endeavour to maintain a public utility, entitling them to the sympathy of the Municipality, the latter successfully "dissembled their love," and adopted every legal method to prevent the exercise of the remedies deliberately provided for. In Genoa, the position was different; and the Company had there been dealt with more fairly. Some years ago the Company spontaneously reduced the price of gas in Genoa, reserving the right to reinstate the old charge if necessary. There they had not been hampered, in a time of great difficulty, by purely partizan action. The same applied to Alessandria. Modena, on the other hand, had adopted obstructive tactics. In France up to the present, it had been impossible to obtain power to increase the price of gas; but there was hope that the Government, recognizing the equities and necessities of the case, might yet give a general authority.

STRASBOURG.

Now about Strasbourg. In 1913, the French Company came to an agreement with the town to convert the gas-works into a local Company; the French Company had been paid in shares and bonds of the German Company for the value of the works, plant, &c. The new Company started in January, 1914. In the French Company's accounts for last year—to June, 1914—Strasbourg contributed, as to the first six months, profits as one of the Company's own stations, and in regard to the second six months interest on the shares and bonds of the new Company. This year it contributed nothing. It was impossible even to obtain accounts. The Directors, however, had heard that the works were going on satisfactorily, and that the French Company's interests had been taken charge of by an Official Receiver. They had also heard that, with Teutonic thoroughness, the Germans had seized the opportunity to remove the three Directors who represented the interests of the French Company, and to alter the statutes so as to reduce the participation of the French Company in the profits. This procedure was of a confiscatory character, and in striking contrast to the treatment of German interests over here. Under the circumstances, the Directors of the French Company wisely determined not to include Strasbourg in the year's accounts.

THE WORKS AND THE WORKING.

He was glad to be able to offer one or two crumbs of comfort to the proprietors. One was that coke had gone up in price during the last few months, and this compensating factor should help to mitigate the position during the coming winter. The other favourable factor was that all the works in which the French Company were interested were at present out of the fighting zone. It was impossible to say whether this would be so always with regard to Strasbourg. But up to the present, there had been no material damage. Regarding the general working at the stations, everything was going on satisfactorily. If only freights had remained as they were when Colonel Le Roy Lewis addressed the proprietors last year, when the German menace was greater than now, he (Mr. Touche) would be able to conclude as their Chairman then did, by saying: "You need not be afraid for the future of the investment which represents such a very large amount in the Company's assets." As things were, the Company's mmediate future was bound up with the freight question, which was ar more important to the prosperity of the nation than many of the ubjects with which politicians were occupying their time. It was not merely a question for traders. It affected everyone, because high freights were a chief factor in the price of commodities, and the high cost of living. He was sorry that he had not been able to lay before the proprietors a more pleasant story. It had been a difficult and trying year or them all; and it must be a disappointment to the proprietors that hey were receiving no dividend. But he thought they would recognize that this was inevitable, under the circumstances. He felt he could not close without bearing testimony to the excellent and unwearied ervices rendered by their Secretary (Mr. Martin) during a year of great difficulty and anxiety. He moved that the report and accounts be eceived and adopted.

Sir Edward Goulding, Bart., M.P., seconded the motion, which, without discussion, was unanimously passed.

Mr. A. F. Phillips, proposing the re-election of Mr. George Alexander Touche and Sir Edward Goulding to their seats at the Board, emarked that the proprietors would realize from the clear statement of heir Chairman the numerous difficulties with which the Directors of the Company had had to contend, and the continual anxiety which had at imes almost brought them to a state of despondency. The proprietors would, he was sure, agree that for the direction and administration of he undertaking, it would be impossible to find a more able gentleman han Mr. Touche. He gave an enormous amount of time to the business, and he was always available to the Secretary when any difficult question cropped up, and such questions occurred almost daily. In Sir Edward Goulding, they had a gentleman of very great experience n the administration of important affairs. He was ever ready to give his best advice, which was always valuable; and he grudged no time or ffort where the Company's interests were concerned.

Mr. Cave Orme, in seconding the motion, said that Mr. Touche had given them a very clear exposition of the unfortunate state of things hat obtained with regard to the French Company, which, of course, was absolutely the bedrock of the prosperity of the Continental Union Gas Company. On the proprietors' side of the table, everyone would ympathize with the Directors of the French Company and the Directors of the Continental Union Company (who were mostly Directors of he French Company) in the trying time they had had. He was afraid t was true that the proprietors had anticipated some such statement as hey had heard, and that it was only the details with which they were not conversant. This being so, they were not surprised by the ale they had listened to. He hoped the state of things might soon be omewhat better than now. For him personally this was a considerable matter, for he was one of the largest shareholders in the Company. All the same, he could not but feel that every effort had been made by he Directors, and everything had been done by the staff to support hem in the trying times they had gone through, to bring the Company out as fairly well as possible. There was only one other remark. He, and he was sure the shareholders generally, would be glad if the accounts of the French Company could be sent to them before the annual meeting. This would, perhaps, enable them to follow with more intelligence what happened at the meeting. They used to get the reports of the French Company prior to the meeting; but the last year or two his had not been so.

The motion was carried unanimously.

The Chairman, on behalf of Sir Edward Goulding and himself, hanked the proprietors for re-electing them, and Mr. Phillips for his more than kind remarks. He had made a note of the suggestion by Mr. Cave Orme, for he realized that it would be an advantage if he shareholders had in their possession the accounts of the French Company before they assembled for their annual meetings. But unfortunately this could not always be done. It depended on whether he French Company's accounts were out in time; and this was determined by the date of their meeting. In recent years they had had heir meeting later than usual; and this year it was particularly difficult for them to get their accounts in shape at an early date. As a matter of fact, the accounts had not yet been published and circulated, o that it would have been impossible for the Directors to send them out to the shareholders of the Continental Union Company.

Proposed by Mr. R. Stevens, and seconded by Mr. Bernard F. Harris, the Auditors (Messrs. A. T. Eastman and C. P. Crookenden) were re-appointed.

This concluded the proceedings.

BRITISH COALITE COMPANY.

The Directors of the British Coalite Company, in their report for the year to Sept. 30, state that the most notable change in financial affairs has been the exercise of their option by the London Electric Company to purchase the Barking land for £71,500. The option was exercised at the end of August last; but owing to the delay in obtaining the consent of the Treasury to the issue necessary to provide the purchase money, further time for completion was granted. When the purchase is completed (as the Directors anticipate it will be shortly), and the first mortgage debentures are redeemed, the present second debentures will automatically become the first charge on the Company's properties. The plant of the Barnsley Smokeless Fuel Company—a subsidiary of this Company—is in process of erection at Barugh, near Barnsley. Owing to the general dislocation caused by the war, progress has been much slower than was anticipated; but the Consulting Engineer is of opinion that the first unit of plant will be erected and working by March next. The expenditure on plant, owing to the increased cost of labour and material, will be greater than was anticipated; and in order to provide the further capital required, and to bring the plant up to a fuller capacity, the Board are informed that the Barnsley Smokeless Fuel Company propose to make a further issue of debentures. The issue has already received the sanction of the Treasury, who have taken half the amount already subscribed.

POWER GAS CORPORATION, LIMITED.

Busy on Government Work.

The Fifteenth Ordinary General Meeting of the Corporation was held last Thursday, at the Westminster Palace Hotel, S.W., under the chairmanship of the Rt. Hon. Sir Alfred Mond, Bart., M.P.

The Secretary (Mr. Arthur G. Baker) read the notice convening the meeting, and the certificate of the Auditors; and the report and accounts were taken as read.

The Chairman, moving the adoption of the report and accounts and the payment of the dividend recommended, said they had reason to congratulate themselves on the final result of the balance-sheet, in view of the very difficult times through which they had been passing. The balance-sheet being made up from September to September, the first few months of the past financial year, being those just after the outbreak of war, were naturally not favourable to an engineering business like that of the Corporation; and at the time it was difficult to know what the future would hold in store for them. Fortunately, as far as they were concerned, they recovered from the cessation of orders or the postponement of those in hand which took place at the beginning of the twelve months, by turning their attention in directions where their efforts were much required—namely, to manufactures connected with the war. The Directors saw, of course, that the ordinary business they had been doing was one that was not likely to be very remunerative, or even possible, during the war, but that there were many forms of activity for which their works and their staff were specially equipped, and to which they could quite well turn their energies. One of the directions in which they turned their attention was the provision of benzol plants, which, of course, were in great demand, as benzol formed one of the fundamental raw materials of high explosives. He was glad to say that their efforts in this way were successful, and that they obtained some very good orders in connection with these plants. They had also been carrying out a great deal of work for the Admiralty and other Government Departments, which, he was happy to be able to tell the shareholders, had proved very satisfactory to those concerned. In addition, they had been supplying many sub-contractors to the Government with apparatus, and the multitudinous things which were needed in the manufacture of munitions. For a long time, in fact, they had been doing practically nothing but Government work; and the works of Messrs. Ashmore, Benson, Pease, and Co., Limited (the Corporation's engineering department), was made a controlled establishment as from Sept. 6 of this year. It might interest the shareholders to know that about 150 members of the staff and workmen had joined the forces, and that this represented some 20 per cent. of the total number employed on the works. Of course, the labour difficulty had been a source of anxiety to the Board, as it had been to others engaged at the present time in industry; and he sometimes thought that it would have been better if a number of the skilled men who had left the Corporation's and other works had been induced rather to stop at home than to go out to the front.

Going through the items of the balance-sheet, the Chairman said there was not a great deal in them that called for comment. With regard to the profit and loss account, they brought forward £7479, and they had made during the year a profit of £20,743, whereas in the case of the previous year the amount brought forward was £3549, and the profit £20,510. Thus the profit had remained at practically the same figure as the year before; but owing to the larger carry-forward, the total on the present occasion was £28,222, as compared with £24,000. As to the report, he had already told them that the Corporation had recovered from the slump which occurred in the first few months of the financial year; and they were now extremely busy, night and day, on a large amount of engineering work, a great deal of which was connected directly with the Ministry of Munitions. He did not, however, think it would be advisable for him to enter into any details, as much of the work they were doing was of a highly confidential character. In view of the amount of profit shown, the Board decided that it would be only fair to the shareholders to somewhat increase the dividend; and for the first time for many years, they felt they were able to recommeud 6 per cent. per annum (less income-tax) on the ordinary shares. They were also asking the shareholders to place to reserve the same sum as last year—namely, £4140, which was the maximum amount they were entitled so to dispose of under the Articles of Association. This would bring the reserve fund up to the substantial figure of £18,500. They also increased the carry-forward from £7479 to £9105; so that the Corporation started another year in a very favourable financial position.

In bringing his remarks to a close, the Chairman said that, so far as the future was concerned, it would be extremely unwise for anyone to hazard any conjectures. All that could be said was that they were now very well employed, and that there appeared to be every prospect of the works being kept busy for some time ahead on contracts which were reasonably remunerative. How much of these profits in the future anybody would be allowed to keep, was a point on which he would not venture to offer an opinion; but, as he was at present advised, it did not appear that the Corporation were liable so far to any excess profits tax under the last Budget.

The resolution was unanimously adopted, after the Chairman had explained, in answer to a question, that the Directors' remuneration, amounting to £3300, was calculated on the same basis as for many years past. The retiring Directors and the Auditors were then re-elected, and the Chairman and the other members of the Board were thanked for their services.

GAS IN RELATION TO MODERN BUSINESS.

Some Remarkable Figures.

In connection with the Birmingham Business Club, Mr. W. M. Mason, the General Secretary of the British Commercial Gas Association, delivered last Friday week, in the Grand Hotel, Birmingham, a topical lecture illustrated by a large number of fine lantern slides. The audience consisted of business men, some of whom, judging by the excellent discussion which followed, were keenly interested, from practical reasons, in the application of gas for manufacturing purposes. The lecture was particularly appropriate to present conditions.

Mr. S. R. Barrett (the Fittings Superintendent of the Birmingham Corporation Gas Department) occupied the chair, and, in opening the proceedings, gave remarkable evidence regarding the present extraordinary demand for gas in Birmingham. He said he was not there to apologize for the request that had been publicly made to the citizens to exercise economy with their domestic gas appliances, though it was one of the ironies of the times that they should have to appeal for economy in consumption after doing everything possible to popularize gas. The conditions had created a wonderful crop of canvassers who called and wrote most urgently pointing out that gas was now absolutely indispensable to domestic comfort. Munition factories had, however, the first call; and the following particulars would give some indication of the abnormal demands they had to meet. During the last twelve months, the increase in gas consumption had reached the enormous figure of 960 million cubic feet over and above the normal demand. The magnitude of this increase would better be understood by the statement that it practically represents the total requirements of such towns as Letchworth, Tamworth, Nuneaton, Rugby, Warwick, Redditch, Droitwich, and Stafford all added together. If they reckoned only the new services of 4 inches and upwards, they found that the supply for munition factories alone was equal to a 46-inch main, over and beyond last year's requirements. The demand was continuous—night and day and Sundays.

Mr. Mason then proceeded with his lecture and indicated some of the vast interests invested in the manufacture and distribution of coal gas. He dealt with the present national needs, showing how gaseous fuel at this time of national stress is in many directions playing an honoured and important part. The ready adaptability of gas appliances to sudden emergency was shown in the remarkable manner in which, in many parts of the country, cooking and heating installations had, at remarkably short notice, been fitted up, and were now doing splendid work in connection with Army catering and equipment, as well as in our hospitals and nursing establishments. The manner in which gas was employed in the preparation of fodder for the horses, ration and biscuit tins for the soldiers at the front, caps, boots, and clothing for the recruits, as well as in the manufacture of revolvers, bayonets, cartridges, and shells of all descriptions, formed an important and highly interesting section. In connection with the training of soldiers, gas plays an important part in the lighting of drill halls, rifle ranges, and swimming baths, and in the provision of adequate supplies of hot water.

The remarkable manner in which gas-furnaces have been adapted to the manufacture of munitions was also shown. Mr. Mason stated that the conversion of old and the initiation of new industrial processes has been going on in this country to a much larger extent than is generally known. This ready adaptability is one more contribution to the genius and energy of the British manufacturer, to the availability of gas and its ready adaptation is due the possibility of making these developments, and of making them so promptly. An example was given of a company who, prior to the war, manufactured musical instruments. The demand having lessened, gas-furnaces were installed in the factory, which is now a highly important adjunct in the production of Army supplies.

In the motor industry and transport equipment, gaseous fuel is in great demand, as in many operations, both in fitting and repairing, a clean, concentrated, easily controlled, intense heat is essential. Gas absolutely meets the requirements in this respect, and has been well-named "Bovrilized" coal.

Reference was made to the fact that the country is dependent for the high explosives required in ever-increasing quantities by our Armies and Navies upon the supply of toluol and benzol, the main supplies of which are obtained from gas-works. The extraction of these essential products, so far from being remunerative, as some ill-informed people seem to think, was really creating a considerable financial loss to the gas industry; but work was everywhere being loyally undertaken.

The developments of gaseous fuel for business and industrial purposes generally was discussed; the rather remarkable statement being made that in Birmingham the annual consumption of industrial gas, excluding that used for engines, is practically as much as the whole town of Blackburn uses for all purposes in a year. The local demand at the present time was so great at the munition factories that domestic users had to be warned to economize in the use of gas for household purposes.

The advantages to be gained by the adoption of a system of gaseous heating as compared with solid-fuel fired furnaces were briefly summarized as follows:

> Economy in the space occupied by the appliance; necessity, and expense in some cases, of the smoke-stack eliminated; practically unlimited choice of position for the furnace, which enables it to be brought into close proximity to the machine workers.
>
> No space required for the storage of fuel, and no removal of ashes.
>
> Increase in output per cubic foot of factory, owing to economy of space occupied by gas-furnaces in comparison with hard-fuel furnaces.
>
> The constant and unvarying supply of fuel of a uniform calorific value, at a fixed rate.
>
> Labour-saving—absence of stoking, storage, and conveyance of fuel.
>
> Rapidity and improved production, due to ability to precisely control correct working temperatures.
>
> In many cases a lower capital expenditure needed for the installations.
>
> Cleanliness, which frequently is of primary importance where furnaces have to be introduced into machine shops, or in close proximity to machines.

An instance was quoted where savings had been affected by the use of gas as compared with coal amounting to 33 per cent. This was not the only economy, as, by the introduction of gas-furnaces, two-thirds of the floor space was released. In other words, it was possible to treble the existing output of the works without the erection of additional buildings.

Lantern slides of interesting photographs were shown of factories where gas had been applied to a large variety of purposes, such as annealing wire, japanning bedsteads, brazing bicycle frames, tempering and colouring steel pens, forging file tangs, firing stained glass, glazing pottery at the Ruskin works, firing enamels on jewellery, putting tyres on locomotive wheels, firing enamels, boiling sweets, wafer making, banana ripening, making "puffed rice" at the "Quaker Oats" factory, drying enamel on "Cherry Blossom" boot polish tins, and so on.

In large institutions, public halls, Government departments, clubs, &c., where meals are provided daily for employees, numbering in some cases over 1100, gas is being increasingly used. In dealing with the quantities of food handled in these huge establishments, and to ensure that the meals are ready for consumption at the right time, it is essential that a clean, easily controlled, and perfectly reliable fuel must be utilized.

Some indication of the value of the adaptations of gas in the newspaper world were also shown. Not only in efficient lighting, but for melting and recasting type, gaseous fuel is now extensively used. The famous "Punch" offices in London are, for instance, fully equipped with gas.

The lecturer's closing piece of advice was that the best preventative of waste was to regularly read the meter and check gas consumption.

We understand that the B.C.G.A. are further improving their service to members by providing, on the lines of the one just reported, lectures and complete sets of lantern slides. These will doubtless prove very useful to busy managers in various parts of the country, who would gladly avail themselves (if the necessary data were available) of the splendid opportunities for local publicity offered by literary and similar societies who arrange series of lectures during the winter. Those interested should communicate with the B.C.G.A. office.

POWER FROM COKE.

In the "Engineering Notes" in yesterday's edition of the "Daily Telegraph," the following appeared:

Writing on the subject of producing power in bulk in a coal-mining district, and transmitting it to the various industrial and other areas requiring light and power, a correspondent suggests that some of the accruing advantages would be:

1. It would avoid the transport of coal, and consequently cheapen the cost of production.
2. It would lessen the use of coal for private and industrial purposes, as the use of electricity for light, heating, and power would be brought within the reach of all.
3. It would enable the coal to be utilized to the best advantage by having the bye products extracted, instead of being wasted by the burning of the coal in open hearths and furnaces.
4. The coke could be sold for many uses, including private consumption, if the public were only made aware of its utility.

He adds that "the only difficulty in carrying through such a scheme would no doubt be the opposition of the vested interests, such as the electric light and gas companies. But it is submitted that the days of vested interests and privileges are gone by, where they conflict with the interests of the public. It is generally agreed that there will be great unrest sooner or later among the industrial classes after the war. At the present time abnormal wages are being paid, which must of necessity raise the standard of comfort, and the trouble will be when slack times come, and the cost of everything is enhanced owing to increased taxation. Anything, therefore, which will go to reduce the cost of manufacture will tend to lessen the cost of living, and thus enable us to compete on better terms in the world's markets. Under these circumstances, it is for the Government to propound a scheme for utilizing to the best possible advantage the coal supplies which Nature has endowed us with, and not allow them to be wasted as they are at the present time."

CITY AND GUILDS OF LONDON EXAMINATIONS.

Reports of the Examiners.

The report on the work of the Department of Technology of the City and Guilds of London Institute, for the session 1914-15, contains extracts from the reports of the examiners on the results of the last examinations.

GAS ENGINEERING.

Mr. Samuel Glover, of St. Helens, who was the Examiner in "Gas Engineering," says:

There is evidence that the study of the construction of apparatus is a side of the subject that does not receive sufficient attention. A knowledge of the theory is not sufficient; and the sketches offered by some students show absolute ignorance of the construction of apparatus. Some students who evidently know the chemistry of the subject reveal ignorance of elementary points on the practical side.

GAS SUPPLY.

Grade I.

Mr. Walter Hole, of Leeds, the Examiner in "Gas Supply," makes the following remarks on the answers of candidates in the two grades; and the questions specifically referred to by him are reproduced:

The chief weaknesses in Grade I. were in connection with Questions 4 and 8. In the former, many students proved themselves incapable of the very simple arithmetical calculation involved. Reference has been made in previous reports to this weakness; and it is a question for serious consideration whether the school authorities might not with advantage require evidence of some degree of mathematical knowledge before students enter the technical class.

In connection with Question 8, many students failed to realize that there was evidence in the pressure chart of faults other than shortness of supply. Considering the increasingly important place which pressure charts must take in solving the daily problems of gas supply, it would be well if students were instructed how to scrutinize these more critically and discriminately. The answers to the pressure chart question set in last year's examinations showed a similar widespread lack of correct interpretation.

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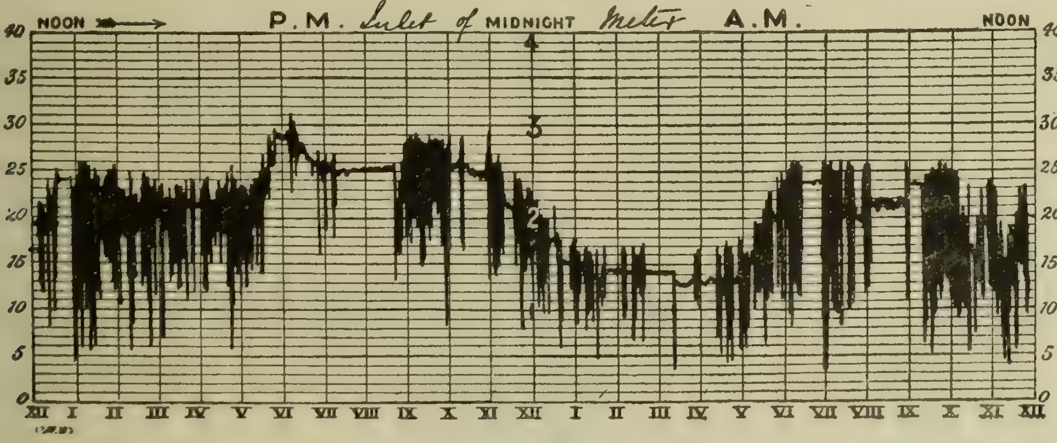
4. A dining-room 18 ft. by 16 ft. by 10 ft. is lighted by two inverted incandescent burners, each consuming $3\frac{1}{2}$ cubic feet of 15-candle power gas per hour. What volume of air will be required per hour for the perfect combustion of the gas, and, assuming that the whole air of the room is renewed three times per hour, what percentage will the air for combustion be of the total passing through the room?

8. If on attending to a complaint of irregular working of a gas-engine you obtained a pressure chart on the inlet of the meter similar to that shown, what fault or faults would you suspect, and how would you proceed?

Final Grade.

With regard to the Final papers, the results were not proportionately so good. In connection with Question 1, many of the calculations were faulty. Even in a few of the best papers students failed to grasp the fact that the question was simply one of discharge under stated conditions, when a certain discharge was already being obtained, and involved themselves in a mass of calculations with respect to pressures, and square roots of pressures, which had nothing whatever to do with the question.



PRESSURE CHART REFERRED TO IN QUESTION 8.

With regard to Question 4, it was remarkable how many students, after working out their calculations correctly, were unable to plot the results in an intelligible polar curve. Several of those who in the end described an approximately correct curve gave themselves the trouble of converting their calculations into the illuminating powers at certain angles before plotting the curve, instead of working directly from a scale drawing on the squared paper. Reference was made to similar faults in last year's report.

Attention may also be drawn to the incomplete answers given to Question 8. Most of the students shirked the simple calculation involved in the first part of the question, and many of those who attempted it were unable to calculate the thermal efficiency from the data given.

Many of the answers to Question 10 were quite inadequate—numbers of candidates being apparently unaware of the existence, or need, of any compensating device in connection with the registration of high-pressure gas.

One pleasing feature of many of the papers in this grade is the intelligence shown in the adaptation of means to ends, particularly in relation to Question 6. In varying phraseology, a good many students have answered, "I have had no practical experience with such a sign; but I think it might be worked. . . ." Then has followed a sketch or description of simple devices very well adapted to secure the result desired. Such answers prove that the students have a very good practical knowledge of the principles and practice of gas supply, and a power of applying them to new conditions, which is altogether admirable.

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1. A 10-inch main is supplying an out-district 2000 yards away, and is found to be delivering 5000 cubic feet of gas per hour. It is required to know how much additional gas the main will discharge when the initial pressure is 4 inches and the final pressure 3·2 inches head of water. There is no consumption along the line of main, but there is a gradual rise from the commencement to the end of the main equal to 40 feet. Solve the problem. ($Q = 1350\, d^2 \sqrt{\frac{p}{s}\frac{d}{l}}$, and the specific gravity of the gas is 0·4, air = 1.

4. Calculate and plot upon the piece of ruled paper given to you the half lower hemispherical polar curve of a high-pressure gas-lamp fixed at a height of 25 feet from the ground level to the centre of the mantle, which is found to give the following illuminating effects at ground level—viz.:

Immediately beneath the lamp	2·5 foot-candles.
At 20 feet from a vertical line passing through lamp	2·1 ,, ,,
At 40 feet ,, ,, ,, ,,	1·5 ,, ,,
,, 60 ,, ,, ,, ,, ,,	1·0 ,, candle.
,, 80 ,, ,, ,, ,, ,,	0·6 ,, ,,

To complete the curve, assume that the lamp gives 3500-candle power along the horizontal line passing through the centre of the mantles. It is assumed that the results at the ground level are obtained on surfaces perpendicular to the beam.

6. Describe the mechanism and working of a four-phase gas-lit flashing sign.

8. A gas-engine, when on full load test, is found to require 15 cubic feet of gas per indicated horse power. Calculate its thermal efficiency when the gas used has a net calorific value of 500 B.Th.U. What are the causes of irregular ignition, and how would you remedy them?

10. Describe precisely the registration device of any high-pressure gas-meter with which you are acquainted, and state upon what constructional points accuracy of measurement depends.

GAS-FITTING.

The detailed report of Mr. H. Kendrick and Mr. R. Halkett, the Examiners in "Gas-Fitting," appeared in the "JOURNAL" for the 23rd ult. [p. 427].

They point out that, though the majority of the candidates succeeded in satisfying the Local Examiners in the practical tests, and thus qualified for admission to the written examination, the answer papers in the latter show that all candidates would do well to attend classes in English, Arithmetic, and Elementary Science before taking a course of instruction in the technical part of the subject. Many candidates in Grade I. failed to do themselves justice because of their inability to describe apparatus even in simple language. In Grade II. and the Final Examination the standard was much higher; but a better knowledge of English and the subsidiary subjects would be of advantage to candidates in these grades also. Teachers are strongly recommended, in order to remedy some of these defects, to insist upon homework notes being written out week by week; and class examinations should be held at intervals throughout the session.

Among the parts of the subject in which candidates exhibited special weaknesses may be mentioned meters, cooking, and testing appliances. In Question 1 of the Final examination, the number of burners to be supplied by a $1\frac{1}{2}$-inch pipe varied between 36 and 124, showing that the answers were mostly guess work. Further instruction should be given on this point. The knowledge of plant, apparatus, tools, and working operations was generally very good; but the flow of gases in pipes and the influence on illumination of colour in globes and surrounding objects is not generally understood, while it is also clear that teachers would do well to explain thoroughly the hot-water system, and the proper method of fixing circulators under different conditions. On the whole, the sketches were fairly well done throughout.

IMPORTED GAS-LAMP CHIMNEYS.

Alleged Austrian Manufacture.

Earlier this month, Mr. Macmaster, in the House of Commons, addressed a question to the Home Secretary as to whether the Government were aware that gas-lamp chimneys manufactured in Austria are being imported into this country by the firm of Messrs. Falk, Stadelmann, and Co., of No. 87, Farringdon Road, and sold in this country as American, and may have come from the United States of America, though not of American manufacture, but clearly of Austrian manufacture, and contained in packing-cases on which the words "Austrian manufacture" are written, although an attempt is made to erase that description; and, if so, what action did he propose to take?

In reply, Sir John Simon said: A number of packages of glass chimneys consigned to this Company from the United States of America have been detained by the Customs, and have been made the subject of inquiry by the Home Office; and two consignments are still under detention. The particular case to which the hon. member calls attention is being investigated; and I will acquaint him with the result.

In the current issue of the "Ironmonger" a letter appears from Messrs. Falk, Stadelmann, and Co., in which they say:

> We consider in justice to ourselves we should be allowed to state that all the consignments mentioned in Sir John Simon's reply have been promptly released. From this it can safely be assumed that the inquiries instituted by the Home Office have fully satisfied this Department.
>
> In Mr. Macmaster's question a particular instance is referred to. The point raised hardly seems deserving of discussion, considering the impracticability of the method alleged to have been adopted. Mr. Macmaster, in his question in the House of Commons, suggested that gas-lamp chimneys, "clearly of Austrian manufacture," and contained in packing-cases on which the words "Austrian manufacture" were written, were being imported into this country by us as American. Even if there had been any desire on our part to evade the Acts against trading with the enemy in this manner, it would probably have been impossible, as well as commercially unprofitable, to do so, because the German and Austrian railways would hardly carry such bulky goods as lamp chimneys in their present congested condition; because the freight from the Continent to America and back is prohibitive—the freight in one direction only being approximately double the value of the goods; and because an import duty of about 50 per cent. *ad valorem* would have had to be paid in the United States on the chimneys before they could be re-shipped.
>
> Mr. Macmaster has been asked, on our behalf, to state the facts at his disposal or to give the name of his informant. This would enable us to meet the insinuation tantamount to our having traded with an enemy country. No reply has so far been received. Apart from this, we believe we are justified in claiming that the reputation gained by our Company during its many years' trading is a guarantee to our many friends in the trade that the alleged facts are not based on good grounds.

AMERICA AND THE DYESTUFF INDUSTRY.

The question, "Do we want a coal-tar chemical industry?" was considered by Dr. Edward E. Pratt, the Chief of the United States Bureau of Foreign and Domestic Commerce, in a paper which he read some weeks ago before the New York Section of the Society of Chemical Industry, and which has now been reproduced in the Society's "Journal."

After quoting figures bearing out his contention that the German coal-tar chemical industry is probably the most highly and completely organized industry in the world, Dr. Pratt says three factors have to be taken into account in considering the American dyestuff industry. These are raw materials, markets, and technical skill. The raw materials in the United States are ample. The coal supply is five times greater than that of Europe. Large quantities, far in excess of those mined in Germany, are required for illumination, for fuel, and for coking purposes in connection with our enormous iron and steel industry. The value of the artificial dyestuffs consumed in the United States amounts to about $15,000,000 annually. This represents one-sixth of the world's output, and over one-fifth of Germany's output. Perhaps in technical skill we are less well equipped; but this is probably on account of the small demand. There are plenty of schools turning out well-equipped chemists who will be available for this work. We need not worry about capital. Capital can be found.

The first American plant was established in Buffalo in 1879. Others were put up, until the total was nine. The manufacture was based, however, on the use of imported intermediates. Attempts to use American raw materials failed, owing largely to the uncertainty of the raw materials. In 1883, five of the nine establishments were closed. Four have continued and flourished, in spite of the keen competition from abroad. One of the largest German dye manufacturers has established a branch factory here, in order to take advantage of a favourable turn in our tariff.

Experiences of American manufacturers in attempting to establish the industry are given; and then the author shows what a great loss is being caused to users of dyestuffs and dyed wares in that country consequent on the cutting-off of supplies from Europe owing to the war. The United States, he says, is not the only nation suffering from this situation. Practically every nation is seriously affected. This is particularly true of Great Britain, where strenuous efforts are being made to start a dyestuff industry. There, the Government, in co-operation

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with the users of dyestuffs, have worked out a plan for the solution of the problem. Similar movements, with more or less of Government co-operation, have been inaugurated in France and Italy. In Russia, a national dyestuff enterprise has been organized and financed by the chief consumers of dyestuffs. Technical and administrative leaders have been supplied by a leading Swiss firm. In Japan, the Parliament has passed a Bill subsidizing dyestuff enterprises. The amount of the subsidy will be sufficient to enable the companies to pay 8 per cent. dividends.

Since the outbreak of the European war, the American coal-tar dyestuff industry has made great strides forward. The factories in existence at that time have greatly increased their output. New establishments for the manufacture of intermediates have been brought into existence; and thousands of tons of benzol and coal-tar heretofore recklessly wasted are now being saved and utilized. The census of manufactures taken in 1909 reported the total output of coal-tar dyestuffs manufactured in this country to be 5,890,000 lbs., valued at $1,813,000. The output was probably much increased over these figures at the outbreak of the European war. Since then, the five domestic concerns manufacturing dyestuffs have doubled their outputs. Another factory, a branch of a large German firm, has greatly increased its output; and still another factory manufacturing aniline has quadrupled its output. But the great need and the great demand for dyestuffs have also brought many new concerns into the field; and our total production of coal-tar dyestuff materials at the present moment is probably over three times the production prior to the European war. In July, 1914, we were saving a scant 10 per cent. of the coke bye-products by means of bye-product recovery coke plants. To-day we are saving not less than 20 per cent. We are making progress; but there is still a long way to go.

During the last normal fiscal year, we imported the following amounts of the principal dyestuffs:—

	1914.	1915.
Alizarin and alizarin dyes . . .	$845,459	$1,586,099
Artificial indigo	1,015,201	1,058,990
Other coal-tar dyes	7,241,406	5,851,887
Total	$9,102,066	$8,496,976

The report soon to be published by the Bureau of Foreign and Domestic Commerce will establish definitely the quantities and values of each of the many items comprised under "alizarin dyes" and especially under "other coal-tar dyes." This report will show exactly the amount of each of the many artificial dyestuffs now in currunt use in this country, consumed by our various textile and other industries during the fiscal year 1914. Such a census of dyestuffs has never been attempted in any country. The accomplishment of this task is absolutely essential for the establishment on our soil of a comprehensive, self-contained coal-tar chemical industry with proper correlation and co-ordination between its manifold divisions and subdivisions. There is still, however, one serious obstacle in the way of the confident and determined development of a coal-tar dyestuff industry on American soil, and this difficulty is the possibility, or rather the certainty, that upon the resumption of normal international conditions European manufacturers will endeavour by boycott, underselling, and other methods of competition, to win back this profitable market, and put out of business a new and struggling dyestuff industry.

Dr. Pratt urges that what has to be guarded against is persistent, determined, unfair competition in its most virulent form under the guise of dumping. This is a matter which, he goes on to state, has been thoroughly discussed by the officials of the Department of Commerce and the Federal Trade Commission; and they have agreed substantially: (1) That foreign concerns should be permitted to exercise no privileges in this country or against concerns in this country which are prohibited to domestic concerns. In other words, what we call unfair competition shall not be permitted any more to foreign concerns than to domestic concerns. (2) That this or any new industry which aims to place us in an independent position industrially among the nations of the world shall be given a fair chance. Recommendation will be made by the Department of Commerce that Congress shall pass such legislation as will accomplish these objects.

Features which should be included in this legislation are set out; and they include the following: (1) Unfair competition should be so defined as to comprehend the practice of sending goods into the United States at prices lower than those current at the point of production for similar qualities and quantities, and under similar conditions of sale. (2) The market price in the country of production should serve as a guide and standard of price. (3) A small leeway of (say) 5 per cent. should be permitted, in order to cover differences in the conditions which are always present in the commerce between two countries. (4) The sporadic sale of certain goods during a brief period, when clearly not intended to undermine American industry, should be excluded from the operation of the law.

In view of the monetary position which will obtain in Europe after the war, Dr. Pratt does not appear to see any reason why American manufacturers should not be able to compete with those of other countries, while as to the desirability of the development of the coal-tar chemical industry in the United States, he points out that the existence of such an industry means the development of a number of other industries directly dependent upon it—such as the manufacture of pharmaceutical preparations, artificial perfumes, photographic chemicals, high explosives, &c. The establishment of this one industry has the indirect effect of assisting and promoting a score of other industries which are dependent upon the use of its products in their processes of manufacture. Chemistry, he adds, has been truly called the intelligence department of the industry. It is, therefore, particularly important that we should develop a chemical industry in the United States, of which the coal-tar industry is perhaps the most important and the most essential part. It is not merely a matter of a single

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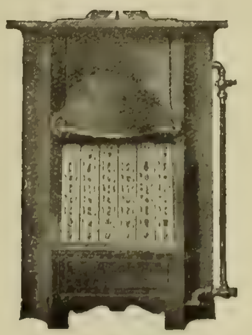
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industry, or the matter of attaining increased efficiency or a wider variety of products in one industry, but applied chemistry is largely the successful utilization of bye-products. Therefore, the development of a chemical industry in the United States means increased efficiency and increased economy in every industry of the country. It is also pertinent to point out that perhaps the fundamental reason for the peculiar success of the German coal-tar chemical industry has been the willingness to devote years and years of effort to careful scientific experimentation or the development of a new process or of a new product. It is this long-time investment for the future, the method of unceasing experimentation, that American industry must learn. The prospective development of any industry—and this is particularly true of the chemical industry—parallels the development of science and knowledge. The nations whose natural products are the most intensely studied and the most thoroughly utilized, are those which attain industrial supremacy.

DISTRIBUTION OF CHEAP COKE IN HOLLAND.

In Holland, where practically all the gas-works are municipally owned, it has been decided in a great many towns to distribute coke at reduced prices for the benefit of the poorer classes. Persons, to be eligible for taking advantage of these reduced prices, must have an income not exceeding a certain amount, which varies in different places. The price is generally about 20 per cent. below the normal market rate. Of course, there is a certain limit to the quantity of coke to be so delivered. In some towns, the weekly maximum for each consumer is fixed at about 1 cwt.; while in other places the quantity is regulated by the extent of the household.

For Amsterdam, about 90 retail dealers in coal and coke have been licensed by the Municipality for the distribution of cheap coke; and the price of the coke is about 13d. per cwt. free in the consumer's house. The coke is delivered on payment with special tickets which are bought in advance; and in order to obtain a coke ticket, it is necessary that the buyer should be a holder of a bread-card, which gives, in its turn, permission to obtain the special bread distributed by the Government. The maximum quantity to be secured by one household amounts to 4 cwt. during December; the minimum being 2 cwt. Coke delivered in this way may only be used by the applicants—passing on to other persons is punished by withdrawing the permit for a month.

During the first week the distribution of cheap coke was in force in Amsterdam, extensive use was made of the opportunity. The first day 2637 tickets were sold. The next day there was a slight fall; but on Wednesday the number rose to 3714, on Thursday 3143, and on Friday the record figure of 4684 was reached. Altogether there were sold about 1000 tons of this cheap coke. As the Corporation have at disposal for December about 3000 tons of coke, there is to be during this month another distribution. It is expected that next month the limit per household will be raised.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The accounts of the Kilmarnock Corporation gas undertaking fo the year ended May 15 last show that at that date the total capita expenditure amounted to £149,975. There was expended on revenu account during the twelve months £32,141; while the receipt amounted to £37,321. There was thus a balance of £5180 to carry t net revenue account, making a total to the credit of this account o £13,107. Interest and sinking fund charges, &c., being deducted from this, leaves a balance of £7441 to be carried forward to next year From the 22,883 tons of coal carbonized, there were made 222,286,10 cubic feet of gas, or 9714 feet per ton; and of this 204,957,952 cubi feet were accounted for, leaving an amount unaccounted for of 7·8 pe cent. The revenue from the sales of gas was £25,377, and from residual products £10,938. As to the price of gas, this worked out a 2s. 3½d. per 1000 cubic feet. The total revenue amounted to 3s. 3·85d per 1000 cubic feet of gas, and the expenditure to 2s. 10·7d.

The Saltcoats Town Council have considered an intimation that, on account of the large decrease in the consumption of gas for street lighting, the Gas Company are unable to supply the gas at the rate hitherto in force; and that for the quantity consumed during the current season the charge will be the same as to ordinary consumers, and subject to the same discounts. The Council agree to accept the notice for the future, but cannot agree to the rate being retrospective.

Under the auspices of the Glasgow and West of Scotland Local Council of the National Registration of Plumbers, a discussion took place last week on the subject of "Lighting," introduced by a lecture by Mr. S. B. Langlands, the Inspector of Lighting of the Glasgow Corporation. The chair was occupied by Mr. J. R. Sutherland (the Corporation Water Engineer), who is President of the Council. In the course of his lecture, which was illustrated by lantern views, Mr. Langlands, after describing primitive modes of lighting, stated that as late as 1840 oil and wick lamps were still in use in some parts of Glasgow. At the outbreak of the war, a scarcity of mantles and electric lighting gear was apprehended, owing to the enormous extent to which these commodities had been procured from enemy countries This difficulty had, however, been effectually surmounted through the broad and enlightened manner in which the Corporation faced the problem. But the trouble as to illuminating glassware was still a serious one; the supplies having hitherto been chiefly drawn from Jena, Silesia, and Bohemia. Glasgow at one time was the home of the glass industry in this country; and the hope was expressed that it might regain its former position. Interesting views were given of street lighting; and the various types of high-pressure gas-lamps were shown. It was pointed out that a great advance was made in public lighting when the Corporation, under the lead of Bailie Bruce Murray, settled a general scheme of public lighting in 1904. Mr. Langlands claimed

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Glasgow to be in normal times the best lit city in the United Kingdom, though London excelled in some parts. In concluding, he expressed the confident hope that in ten years from now he would be able to perform the switching on and off of the public lights of the city from centres. A cordial vote of thanks was accorded to the lecturer, on the motion of Bailie Bruce Murray.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Dec.* 20.

There is nothing of particular interest to record in the market for tar products, and values generally remain unaltered.

There has been a further advance in the price of sulphate of ammonia, and business is reported at £16 15s. per ton net, into buyers' bags, at makers' works, for 25 per cent. quality, for January delivery.

Tar Products in the Provinces.

Dec. 20.

The market for tar products remains about the same, and there is nothing fresh to communicate. Pitch is still very weak, and business is reported at low prices. Solvent and heavy naphthas continue in good demand. Creosote is quiet.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 6d. naked. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

Liverpool, *Dec.* 18.

Although the pace has been slower during the past week than has recently been the case, this material has not ceased to gain in value, and at the close the tendency is still upwards. There has been good inquiry from foreign buyers, as well as from British dealers, but the volume of business has been rather restricted by the limited quantity offered for sale. The prices for prompt delivery are now £17 2s. 6d. per ton f.o.b. Hull, £17 7s. 6d. f.o.b. Liverpool, and £17 10s. f.o.b. Leith. For future shipment, it has transpired that transactions have taken place at £17 12s. 6d. per ton for January-March, £17 2s. 6d. for April-June, and again at £16 10s. for July-December delivery, f.o.b. good ports.

Nitrate of Soda.

The tone of the spot market has hardened still more, and quotations have been raised to 15s. 3d. per cwt. for ordinary quality, and 16s. 3d. for refined.

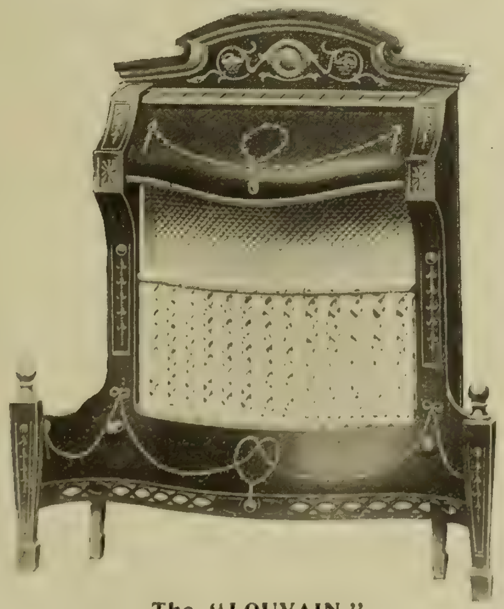
Sulphate of Ammonia.

From another source, it is stated that this market continues very firm and still shows an upward tendency. Outside London, makes are quoted at £16 5s.; Hull, £17; Leith, £17 5s.; Liverpool, £17 2s. 6d. to £17 5s.; Middlesbrough, £17.

COAL TRADE REPORT.

Northern Coal Trade.

There is now the pressure in the demand for coal usual just before the great holiday; and this has stiffened prices, though more manufacturing coal may be put on the market. In the steam coal trade, the demand has been fuller than is usual at this season, and prices are higher. Best Northumbrian steams are very firm; and they are quoted from 21s. 9d. to 22s. per ton f.o.b. Second-class steams are about 18s. per ton; and steam smalls are steady at 10s. to 13s. per ton f.o.b., according to quality. Production is fairly full; but the large supplies demanded for the use of the Government have tended to scarcity and firm prices in general, and this will influence quotations for the next two or three weeks. In the gas coal trade, the demand is now at its fullest. There have been good deliveries; while for any quantities available beyond the long contracts values are strong. Best Durham gas coals are 20s. per ton f.o.b.; for second-class gas coals, 18s. 6d. is the current price; and "Wear Specials" are from 21s. to 22s. per ton f.o.b. Little is doing in contracts just at present. The rates of freight are very high; but where coal can be shipped very early, concessions may be made, and the rates of freight are thus momentarily easier. Gas coal from Tyne to London is perhaps about 15s. to 15s. 3d. per ton, though coal is being carried on contract at much lower prices. For the next two weeks, a lessened output must be expected at the pits. Coke has been a little affected by the need for licences in some branches of the trade. Gas coke is in full output, but on the whole it is well taken up, both for export and for the home trade. Good gas coke may now be quoted from 28s. to 29s. 6d. per ton f.o.b.; but the trade has also to meet very heavy freight rates on the part of the produce sent overseas, though these will be irregular during the next two or three weeks.



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Sale of Gloucester Gas Stock.—In connection with a deceased shareholder's estate, £7500 of consolidated ordinary stock in the Gloucester Gas Company was lately offered for sale by auction. Only about half of the amount, however, was disposed of. The stock was put up in lots of £100, and sold with the accruing half-year's dividend; the prices realized being £95 10s. and £95 per lot.

Gas Supply Difficulties at Ripon.—The operating of the Ripon Corporation Gas-Works is becoming a serious problem. It seems that there was a partial failure of the supply on Monday night last week, and recourse had to be had by many citizens to oil-lamps and candles. For some time there has been difficulty in maintaining an efficient gas supply in the city, chiefly owing to the increased consumption (for which the military camp is mainly responsible), coupled with the scarcity of labour. To such straits, it is said, have the Gas Committee been reduced, that an application has been made to the military authorities for men, and arrangements were come to.

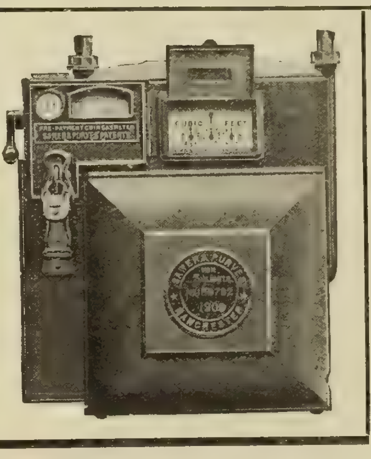
Barnsley Arbitration Award.—The demand for increased wages by stokers, enginemen, and firemen employed by the Barnsley Gas Company has been the subject of arbitration proceedings, as was reported last week, p. 604. Mr. C. H. Blackburn (the District Secretary of the National Union of Gas Workers and General Labourers) has now reported to the members the result of the award, which gives each man six days' holiday per year, with full pay, in addition to a war wage of 6d. per shift, making a total advance, on the hours worked per week, of 3s. 9d. This is in addition to pay at the rate of time-and-a-half for week-end work, which was recently granted by the Company, and is equal to an increase of 2s. 10½d. per week. The men contended that the advance should be retrospective to the time when the notices expired; and Mr. H. Hutchinson (the Manager of the Company), after some negotiation, agreed to submit this claim to the Directors.

Fatality at Maryport Gas-Works.—A fatal accident at the Maryport Gas-Works was the subject of an inquiry by a Coroner's Jury. On the 2nd inst., Robert Wickholm, a stoker at the gas-works, was drawing the ashes from a step-bar furnace, one of the bars of which was broken. This, it is conjectured, escaped the notice of Wickholm, who drew the hot ashes, with the result that they dropped into the water. The resulting steam scalded Wickholm about the head, neck, chest, and face so severely that he subsequently died from exhaustion. From the evidence of Mr. Clarence Harris (the Manager), it appeared that deceased had to descend into a cellar 7 feet deep by 8 feet square to do this work. Since the accident, he had ordered the water to be drawn off before the ashes were removed; and this would prevent such an accident in the future. It was the custom at gas-works to have water standing; but in the case of a similar accident, the Jury had recommended that it be first drawn off. He expressed his sorrow at the accident, and said the Gas Committee would defray the cost of interment. Some of the Jury were inclined to recommend an enlargement of the cellar; but on it being pointed out that the drawing-off of the water would be an effectual safeguard, a verdict of "Accidental death," without a rider, was returned.

Gas Fatality at Aston.—Mrs. Mary Perrett, of Aston, who had been in poor health for some time, and had been worried by the thought that her son might have to go to the front, was found dead in bed, with the gas in the room turned fully on, but not lighted. It was stated at the inquest that death was due to gas poisoning; and the Jury returned an open verdict.

The Difficulties of a "Minimum Rate" Supply for Electricity.—A year's experience with the reduced electricity rates effected by an order of the Public Service Commission of the State of New York has caused some confusion on the part of small customers of the Municipal Gas Company of Albany over the "minimum charge" of $9 a year. In cases where less than this worth of current was used last year, the Company were met with a number of objections when bills were presented in July for the balance represented by the difference. The Commission has accordingly now made an order which it is hoped will do away with confusion. In any month in which a customer's bill for current is less than 75c., the Company are permitted to send in a bill for this minimum under the rates provided. If at the end of the year, the Company have collected more than $9 and the customer has not used this worth of current, the Company will refund the difference between the amount collected and the $9 minimum. It has also been found that a good deal of trouble is caused by reason of the fact that the year on which the minimum is reckoned ends on July 31, while the Company's fiscal year ends on Dec. 31. The Company are therefore authorized to make this year coincide with its fiscal year beginning on the 1st prox. Minimum charges for shorter periods will be pro-rated and considered as $3·75 for the five months.

Death from Mond Gas Poisoning.—The fracture of a Mond-gas main at Tipton, resulted in the death of a widow named Elizabeth Griffiths, aged 71. At the inquest, a daughter stated that on going to bed last Saturday week, she found her baby black in the face, and foaming at the mouth. She started off for a doctor, but in crossing the road was overcome by gas and rendered unconscious. Another witness said she heard a pipe burst in the road, and discovered gas in her cellar. Subsequently, the people living in the vicinity of the escape were called up and removed to a place of safety. Mrs. Griffiths was found unconscious, but recovered. Apparently, however, she returned to the house for her belongings, for she was found outside the back door dead. Dr. Brown expressed the opinion that death was due to poisoning by Mond gas, which consisted largely of carbon monoxide. Mr. H. Carder (the Secretary of the Mond Gas Company) said the fracture of the main was probably due to ground subsidence, through mining. The whole of the Mond-gas mains were of steel; and at various points there were double collars to reduce the risk of fracture. On Saturday afternoon the main was examined, as it was every week, and there was no sign of leakage. That night, however, there was a sinking of the road. When the ground was opened, it was found that a flange had been torn away from a pipe, leaving a gap all round of about ¾-inch in width, with a pull towards a colliery. A verdict of "Accidental death" was returned.



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A Defective Gas-Tap.—At an inquest at Darlington on a five-year-old girl named Ellen Thompson, who was found dead in bed at the house of her grandparents, it was stated that the great-grandmother went to the house and slept with the child, and apparently turned a defective gas-tap too far in extinguishing the light, so allowing the gas to escape throughout the night. It was mentioned that the tap had been defective for nine years, "but was understood by the members of the family."

Water Charges at Godalming.—Under the Godalming Corporation Water Act, the same charges are made to consumers inside and outside the borough; and if, after the payment of all legitimate charges, there is any surplus revenue, the balance has to be divided between the borough and the outside areas in proportion to the water-rents from the respective districts. If, on the other hand, there is a loss, the Godalming ratepayers have to make good the whole of the deficiency; and during the last few years they have, in this way, had to find about £11,000. This state of affairs the Corporation desire to see altered; but the attitude taken by the outside areas is that Godalming made a bad bargain and must stick to it. An inquiry was held last week by a Local Government Board inspector, consequent on the steps being taken by the Corporation to get power to vary the water charges from time to time as may be necessary—still keeping the rates inside and outside the borough the same.

APPLICATIONS FOR LETTERS PATENT.

17,099.—Anderson, W., and Meikle, J., "Production of toluol, benzol, &c." Dec. 6.

17,140.—Major, J. L., "Production of oils from coal-tars and the like, and also carbon and pitch which may be free, or relatively free, from uncombined carbon." Dec. 6.

17,232.—Humphries, H. B. P., "Cooling and purifying gas." Dec. 8.

17,256.—Riter-Conley Manufacturing Company, "Operating gas-producers in the manufacture of coal gas." Dec. 8.

17,318.—Travis, S., and the National Gas-Engine Company, Ltd., "Gas-engines." Dec. 9.

Tees Valley Water Board.—At the meeting of the Tees Valley Water Board last Monday week, it was reported that, with the recent expenditure of £1376, the total cost of the undertaking since purchase amounted to £2,899,047. The revenue for the past half year of £63,193 was less by £1472 than the figures for the preceding half year, and £1621 more than for the corresponding half of 1914. During the half year, £48,000 was paid out of revenue to the Corporations of Middlesbrough, Stockton, and Thornaby; and a further £7500 to Middlesbrough, £6250 to Stockton, and £1250 to Thornaby was to be made.

STOCK MARKET REPORT.

The Stock Exchange has had a week of very quiet business—not an uncommon feature when Christmas is imminent, even in the piping times of peace. But an extraordinary factor to interfere with ordinary dealings was present last week, in the shape of more War Loans. Scarcely had the subscription list closed for the great French loan (which, by the way, was a great success, and at once commanded a nice premium), than the Treasury launched its novel Exchequer Bond scheme, for this is practically, though not nominally, a War Loan. Attractive as this is, its details have not escaped criticism; and it is widely thought that the £100 bond is too big to reach the savings of "the people." If this is (as it should be) the object of the Government, they have not gone the best way to effect their purpose. One result of the new issue was to weaken the market price of the 4½ per cent. War Loan and Consols; but before the close they looked like making a rally. Other markets in general were mostly dull. American prices were lower. Home Rails, after a gallant attempt to advance, fell back, and South African moved irregularly. The Foreign Market was flat until the French loan came and brightened it. Japanese and Chinese issues were firmer. There were hopeful indications of amendment in Mexican prospects; but things are doubtful as yet. Argentina is perturbed by locusts and bad weather. Shipping concerns were variable, and rubber showed improved strength. Inside the Exchange, the scheme for effecting the mobilization of United States securities came in for much discussion; and the House was not pleased to note that it contained no provision for commissions to members. Business in the Gas Market was again upon a scale of very reduced proportions; but at this season any advance towards a recovery of animation could scarcely be expected. Prices in general were at about normal figures, and did not exhibit any curious anomalies such as have been noted once or twice lately, and which seemed almost suggestive of *errata*. In the Money Market, there was an abundant supply. The issue of 5 per cent. Exchequer Bonds stiffened discount rates to some extent.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 73¾, 74, South Metropolitan 78⅜, 79, South Suburban 86. On Tuesday, Bombay 4¾, Bristol 90, European 12 11/16, Gas Light maximum 60, 60¼, Imperial Continental 83¾, South Metropolitan 79, South Suburban 86½. On Wednesday, Gas Light ordinary 72½, 72⅞, 73, ditto preference 75, 75¼, Primitiva preference 3 21/32, 3⅞, South Metropolitan 78¾, 79, 79¼, South Suburban 86, 86½. On Thursday, Bombay 5 1/16, Gas Light ordinary 72, 72¼, 72½, ditto maximum 60, 60¼, Newcastle 82, River Plate debenture 70, South Metropolitan 78¾, 79, 79½, ditto debenture, 61, Tottenham "B" 96. On Friday, Commercial 4 per cent. 83, Gas Light ordinary 72, 72⅜, ditto maximum 60¼, ditto preference 75½, Imperial Continental 82½, 82¾ On Saturday, Gas Light ordinary 72¼, 72½, ditto maximum 60½, ditto preference, 76, South Metropolitan 78½.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

It is, says the "Builder," stated that the Gas Committee of the Chesterfield Corporation have agreed to try an experiment with luminous paint on some of the gas-standards where the light is extinguished, to see if it will help pedestrians to negotiate the darkest places.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅓	Alliance & Dublin Ord.	59—64	3 18 2	..
374,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd. . . .	5⅞—6⅜	5 17 8	4¾—5 1/16
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c. . .	29—30	5 6 8	..
373,480	10	"	7	7/-	B 7 p.c. .	15—15½	4 10 4	..
95,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
147,2 0	—	—	—	4	Deb. . .	..	—	..
380,000	Stk.	Feb. 26	†14	†6/-	Brentford Consolidated	261—266	5 5 3	..
330,000	"	"	†11	55/-	Do. New . . .	204—209	5 5 3	..
50,000	"	"	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb. .	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	7¾	Do. A Ord. Stk. .	154—159	5 0 8	.
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref. .	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	.
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	83
560,000	"	"	5⅓	46/8	Do. 3½ p.c. do. .	103—105	5 1 6	..
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,420	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk. . . .	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk. .	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord. . .	98—102	4 15 6	72—74
2,600,000	"	"	3½	3½	3½ p.c. max. .	76—79	4 8 7	60—60½
4,062,235	"	"	4	4	4 p.c. Con. Pref.	96—99	4 0 10	75—76
4,674,850	"	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	..
130,000	"	"	10	10	10 p.c. Bonds .	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16¼—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C . . .	151—154	5 2 4	..
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
4,940,000	Stk	May 14	9	4½	Imperial Continental .	150—160	5 12 6	82½—83¾
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
561,000	Stk	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7		Liverpool 5 p.c. Ord. B	146—148	4 14 7	
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	6	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4¼	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	82
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅔	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B . .	128—131	4 19 8	..
100,000	50	"	12	60/-	Do. C . .	118—121	4 19 2	..
52,000	50	"	10	—	Do. D . .	..	—	..
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	6 13 4	..
499,960	5	June 26	5	2/6	" 5 p.c. Pref. .	4¾—5	5 0 0	3 21/32—3⅞
521,600	100	June 2	4	4	" 4 p.c. Deb. .	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	70
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8	..
209,984	"	"	10	10	Do. B	222—224	4 9 8	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	78⅜—79½
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	61
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	86—86½
60,000	"	"	5	5	Do. 5 p.c. Pref. .	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent. .	..	—	..
187,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c. .	185—188	5 8 8	..
742,275	"	"	6	6	B 3½ p.c. .	115—117	5 2 7	96
181,255	"	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8¾	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	..
108,075	"	"	5/17/8	55/1½	" C 3½ p.c.	110—115	5 2 0	..
352,000	"	"	6¼	57/6	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	"	"	6⅞	63/9	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

Coke-Oven Gas for Middlesbrough.—The Middlesbrough Corporation, in pursuance of a wide and comprehensive scheme for municipal saving, are proposing to avail themselves more fully of gas from coke-ovens for lighting purposes, and are in negotiation with Messrs. Sir B. Samuelson and Co., Limited, with a view to obtaining an increased supply.

Lurgan Gas-Works Purchase.—At a special meeting, the Lurgan Town Council have decided, owing to the restrictions imposed by the Treasury prohibiting the raising of a loan to pay for the purchase of the gas undertaking, that they will give mortgages to the Company's shareholders; these mortgages to bear interest at 5 per cent. per annum. The sum to be raised is between £40,000 and £50,000.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Superintendent. Portsea Island Gas Company. Applications by Jan. 1.
Manager. Louth Gas Company. Applications by Jan. 5.
Draughtsman. Bale and Hardy, 39, Victoria Street, S.W.
Working Manager. No. 6127.
Chief Cashier and Accountant. No. 6126.

Appointments, &c., Vacant (*continued*).

Works Foreman. Rugby Gas Company. Applications by Dec. 28.

Plant, &c. (Second Hand), for Sale.

Steam Engines and Blowers. Aldershot Gas, &c., Company.

TENDERS FOR

Tar and Liquor.

Brecon Gas Company. Tenders by Jan. 3.
Sheppy Gas Company. Tenders by Dec. 29.

Tar Dehydrating Plant.

Torquay Town Council. Tenders by Dec. 29.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

CHRISTMAS HOLIDAYS.

It is proposed to issue the "JOURNAL" a day later next week—on Wednesday rather than Tuesday.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1916 are reminded that this can only be done before the end of January.

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JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXXXII., No. 2746.] TUESDAY, DECEMBER 28, 1915. [67TH YEAR.

1915.

A Retrospect.

A WHOLE year of war, and the conditions of life and of the world all unparalleled! When last we sat down to review a year's work in relation to the industrial interests in which our readers and ourselves are concerned, there had been five months of war—a mere foretaste of what was to follow, for what has followed has surpassed all human preconception. But, in those five months, the belligerent nations and the rest of the (how strange the word in relation to the conditions!) civilized world, had felt that they had lived an age. Those were the months in which hopes and fears were jumbled up confusedly, through the success of the Prussian Army in over-running Belgium and the North of France, and through the military preparedness of Germany and Austria, and the obvious deficiency of our own country and certain of our Allies, for land warfare, though on the sea the mastery was indisputably ours. Those were the months, too, in which chaos ruled in industry. But in the year now drawing to a close we have industrially settled down on to what appears to be bedrock conditions under the circumstances of the terrible and costly contest of mighty forces—costly in the fearful destruction of human life and property, and in the expenditure of the wealth of the nations engaged in the war. The price is great, but the cause of this country and of her Allies is just. The experiences, the episodes of, and the requirements in, the new warfare have largely during the year monopolized the minds of the peoples of all the world. The theatres of war have spread; the number of nations engaged has been increased. The hands of those nations arrayed against the tyrannism of Prussian militarism are full. Though the clouds are heavy in the Balkans, Mesopotamia, and the Dardanelles, the prospect to-day appears brighter than it has been at any period of the year; but while we look upon the position and the prospect as brighter, and as promising a speedier termination of the war than anyone dared to hope for but a few months since, still the events and incidents and changes in situation that have come upon us with such swiftness, and in such kaleidoscopic fashion, in the course of the year, naturally cause a judicious tempering of any certainty on the score of an early restoration of peace, though there is perfect confidence as to the ultimate end.

To this position we have arrived by a road of intense new warfare, marked by barbarities made possible by the advances of science. This appears paradoxical; but the truth is attested by occurrences of diabolical conception. On land, apart from the ordinary methods of warfare, the Germans introduced the demoniacal methods of producing death and suffering by gassing and flame; by sea they sought to shake the nerve of this and other countries by sending helpless men, women, and children to a watery grave by the use of the submarine, as witness the sinking of the "Lusitania," the "Arabic," and other liners. All this was nothing less than cowardly, calculated, cold-blooded murder, which caused shocks to run through the whole civilized world, and branded the German nation, or rather the rulers, as arch-fiends in the basest brutality. There was also the attack on unarmed merchant vessels and fishing boats, by which there was not only loss of vessels and cargoes, but further murder of helpless men. But the British Navy, by submarine captures and destruction, gradually weakened the enemy's power in this direction, and left them to rage over the spectacle of Britons undismayed. There was also the bombardment of unfortified towns on our coasts, and more murder of peaceful residents, including women and children. The British Navy, by the battle in the North Sea towards the end of January, and the loss it occasioned the German Navy, put an end to further exploits of a similar character. There have been the nocturnal raids by air, in which nothing of military importance has been achieved; but homes have been wrecked, and men, women, and children have been killed and maimed by bombs and fires. The Germans have proved themselves supreme masters in the art of cowardly and belial warfare; and their actions will not be speedily forgotten after the conclusion of peace. But amid it all, Great Britain and her Allies have proved their invincible courage, have evidenced their ability to conduct warfare according to the laws and the usages of civilized nations, have shown their power of resource in repairing any past defect in their equipment to meet a military organization which has taken decades to build up, and have exhibited their great financial resource, and their power to go forward as long as the enemy can hold out—and longer. The rulers of the enemy countries know this to-day; and they are well aware there is to be a day of reckoning.

There is confidence in this country and in those of her Allies, that not only in final defeat will all the barbarity of this war be fitly punished, but that before peace is declared our enemies will find themselves in an exhausted condition both economically and materially, and will be glad enough to relinquish, as part of the terms of peace, the lands which they are now holding while the process of exhaustion proceeds. They are in occupation of Belgium, a valuable portion of France, Poland, a part of Galicia, and Serbia. These are temporary possessions. They are causing this country to spend some millions sterling a day; but their own expenditure is greater. On the other hand, the failures of the enemy have been severe. Their armies have not fulfilled Prussian boasts that Paris, Calais, and Petrograd would fall into their hands. Egypt and the Suez Canal are not under German protection, as it was hoped by the enemy they would be. Germany has to scan the globe with minuteness to discover a possession that it can call its own outside Europe. There is German East Africa, but that is marked for conquest and change of proprietorship. Neither Germany nor Austria has any overseas trade; the overseas trade of the Allies is proceeding as usual. There is not a German ship sailing the seas to-day, thanks to the British Navy, which has sent to the bottom or destroyed every enemy warship that was openly afloat, and away from home refuges, at the beginning of the war. Our Navy was never stronger than at present, our Army was never greater or so well armed, and the country was never better organized for the production of munitions. It has been a case of a nation awakened; and the best use has been made of our old dormant resources in these directions. While the German nation has been fed by its masters on deception, and has experienced internal conditions growing worse and worse and visibly weakening daily, this country and her Allies have been day by day gaining in strength for the great and final struggle that must come—perhaps sooner than may to-day be generally expected. All over the globe, the nations are enriching themselves at the expense of Germany's and Austria's commercial impotence; and when these countries emerge from their confinement to again take part in outer affairs, they will look on a different world from that which they left seventeen months ago, and on people in it with vastly changed feelings towards them, and people less willing to trade with a nation that has had recourse to such foul work. Respect cannot exist under such circumstance; loathing can—and will.

WAR AND TRADE.

In the course of the year, the country has been busy in the direction of showing its capacity for making itself to large extent independent of the enemy countries, and to making more effective in many directions trade competition with those countries when the war terminates. To this end, under the *ægis* of the Government, various Committees have been appointed, and various industries have, through their own organizations, been discussing the position. All that without anything being done. At these conferences it was suggested that section 4 of the Eight Hours Act should be suspended, in order to increase available supplies through extra working hours. But it may be admitted at once that this plan has not been adopted. Appointed by the Home Office was the Coal Mining Organizing Committee, with Sir Richard Redmayne, K.C.B., as Chairman. And their report showed conclusively that the position as to supplies was amenable to correction if the miners would only put in full time under existing conditions, seeing that (despite the fact that probably 190,000 miners had at this stage joined the army, which number is largely reduced by workers drafted into the mines from other industries) the demand on the mines was lessened by the considerable reduction of exports. The matter of the suspension of the Eight Hours Act was discussed several times; but strong objection was raised by both the colliery owners and the miners, on the ground of the difficulty that would ensue from any interference with present working conditions. At a Home Office conference, it was decided that the prevailing conditions should not be disturbed, but that all efforts should be made to reduce absenteeism. If this is not effectual, the matter of the suspension of the Act is to be revived. There is an evident strong reluctance on the part of the Government to do anything to which the miners could seriously object, as the Government and the country have had a taste of the power of the miners to do injury during the war, if selfishly and unpatriotically inclined—as witness South Wales on more than one occasion during the year.

EFFECTIVE MOVEMENT.

However, there were deputations to the President of the Board of Trade by representatives of the gas industry; but nothing definite, beyond the weight and influence of the arguments advanced, immediately resulted. There was a larger movement to be made. It originated with the Manchester Institution; the proposal being that a national conference of the gas and electrical interests should be held, with the view of impressing upon the Government the dangerous position to which things were tending, and the perilous situation in which the community would find itself in regard to supplies of gas and electricity if something ameliorating was not speedily accomplished, and not only the community, but the nation, through the retarding of the work on munitions of war by reduction of the supplies of gas and electricity, and through the capacity of the gas industry in respect of toluol output being reduced—the extraction of which by that time was being performed at a large number of works. The suggestion matured. A conference of the gas and electrical interests was held at the Institution of Electrical Engineers, with Sir Corbet Woodall in the chair; and at the conference a representative Committee was appointed to lay the position before members of Parliament. Conferences were arranged; and, largely due to the irresistible influence of Mr. R. J. Neville-Neville, M.P., Chairman of the Brentford Gas Company, something like 200 members of Parliament assembled to hear what the deputation from the gas-electrical conference had to say. The legislators were impressed by the arguments laid before them; and particularly the one used by Mr. Charles Carpenter to the effect that, instead of the gas industry having to beg Parliament to help them in the matter of coal supplies, the Government should be begging (as they have been begging) the gas industry to help them more and more in the matter of the provision of high explosives. A Parliamentary Committee was appointed, of which Sir Corbet Woodall was also made a member, for the purpose of submitting to the Government the facts of the situation. This Committee, among other things, made a suggestion that the price of coal should be regulated, by taking the maximum pithead price paid for substantial quantities in each class of coal sold during the twelve months preceding the war, and adding 4s. 3d. per ton to cover increased costs due to the existence of the war. This was an improvement on the method suggested by the Board of Trade Committee, that the Government should assume control of the output.

COAL PRICES.

Let us break off here to see what had been happening, and was still happening, outside the movement that was being made to secure parliamentary intervention. The coal owners were in regard to shortage of supply taking their stand on the enlistment of the miners, while opposed to this were the ascertained facts that the savings in export and full-time working on the part of the miners would give all that this country and its Allies needed, and still leave something over for business with neutral countries. As to prices, the coal owners pleaded the law of supply and demand, which highly abused "law" they were interpreting as a right to secure the uttermost farthing which the power of possession gave them, without consideration of abnormal circumstances and national interests. They were talking of 5s., 6s., and even 7s. 6d. per ton for new contracts. Mr. Runciman invited the coal owners to see him, and discuss the position. A result of this interview was a resolution by the owners: "This meeting of coal owners, having a desire to moderate the prices of coal for home consumption so far as may be practicable in the interests of the country recommend that the question of the prices of such coal be considered by coal owners in the various districts with this object in view." The sincerity that underlay this resolution, and the fervour with which the "recommendation" was adopted, was not disclosed by what followed. And that the "desire" to subscribe to the interests of the country by a moderation of prices was quite a new-born one, and that brief life was its portion, is illustrated by the facts that the Midland coal owners only the week before circulated a recommendation that the contract price of gas coals should be raised 5s. or 6s. per ton throughout the country, and that just after this gas undertakings who were anxious to effect early contracts were compelled to pay advances from 5s. to 7s. 6d. per ton upon the prices of contracts then soon to expire. This alone, without calculating any of the attendant extra charges in the handling of the coal, meant 5d. to 7½d extra per 1000 cubic feet of gas. In some cases, the contract prices were 60 to 75 per cent. higher than were being paid for certain classes of coal in 1909-11.

Those who entered into contracts between January and early in March were fortunate; for, taking Durham prices to illustrate the position, for best gas coals they were then varying between 12s. 3d. to 13s., and for second-class qualities from 11s. 9d. to 12s. 3d., while "Wear Specials" were 13s. to 13s. 6d. Then there was a sudden vertical flight and by the beginning of April 22s. 6d., 21s., and 22s. 6d. to 23s. 6d. were being quoted for the three classes of coal just mentioned. By the beginning of May, another shilling or so had to be added to these prices. What possibly could have occurred in two or three weeks to have warranted half-a-sovereign and more being attached to pre-existing prices? Since then the quotations have shifted about within (say) 3s. or so below the April-May prices. But the quotations do not necessarily represent the prices paid under the Coal Prices Regulation Act, to be noticed presently.

THE BURDEN OF FREIGHTS.

At the same time, there was the ruinous position of rate of freight. Mention has been made of the non-interferenc of the Government in this matter, which is a mystery, and has never been satisfactorily explained, and of the protection which they exercised over the inflated market rates fo freight by compelling the payment of these market rates fo the use of interned enemy vessels. Before the war, freight from the Tyne to London were round about 2s. 9d. and 3s per ton. There was an agreement by certain gas companie to pay an increase of 3s. per ton upon the contract rates, t cover the reduced earning capacity of the steamers owin to the restrictions on running, higher wages, increased fue costs, and insurance against war risks. All computation show that this allowance generously covered all the extras and so do the experiences of the London Gas Companie with their own vessels. Including all additional expense occasioned by the war, as well as interest and depreciation the Gas Light and Coke, the Commercial, and the Wands worth Companies were, during the six months ending June carrying coal in their own vessels at a cost of 3s. 2d. to 4s odd per ton. But "market rates" went up to 10s. 6d., 11s 12s. 6d., and other figures (even 17s. 6d. was once quoted at different periods. Then down went the rate in th summer months (after the Coal Exports Regulation Com mittee had got well to work) to 7s. 6d., at which it remained or thereabouts, for a time. Then it again rose until, at th time of writing, it is standing at the exorbitant figure o 14s. 6d. This is only an instance, for terribly high figure prevailed for all parts of the world; and gas companie abroad who were fortunate enough to get British coal wer

fortunate in the prices that they had to pay to get the
l to the nearest port to their works. At the meeting of
Continental Union Gas Company, as reported last week,
was stated that, while the normal rate of freight to Genoa
s 8s. per ton, it had gone up to 66s. and 66s. 6d.—the differ-
ce representing, without the enhanced cost of coal, about
per 1000 cubic feet. There was no question that tonnage
s short; but there is equally no denying the fact that
ere was no "law" that put a limit upon the shipowners'
mands, and that left them with a fair, instead of an ex-
itant, profit on the service rendered. The nation suffered
consequence of this, and so did our Allies. Not until
e in the year were Orders in Council issued which pro-
ited British ships carrying cargo from one foreign port
another foreign port, and appointed a Requisitioning
mmittee whose functions are to secure that tonnage shall
available, in case of need, for foodstuffs and other neces-
ries, and to prevent freights rising to prohibitive rates.
hat will be the effect of this Committee has yet to be
en. But the profits of cargo-carrying companies during
year have been phenomenal; and the market prices of
ir shares have risen to extraordinary figures. The high
ights, combined with the high price of coal, have im-
sed a very heavy burden on gas undertakings relying on
borne coal, and account for a large share of the con-
erable advances that have had to be made in the price of
s. Those companies who possess ships of their own were
tunate: and some of those who do so—such as the Gas
ght and Commercial Companies—found it to their advan-
ge, though high prices had to be paid, to purchase addi-
nal second-hand vessels. The South Metropolitan Com-
ny, who had hitherto only chartered vessels, also became
ners. The Gas Light and Coke Company were unfortu-
te in having certain of their vessels torpedoed or mined
among them the large and comparatively new ship the
Fulgens." The smaller concerns who looked to water
rriage for supplies were heavily hit, as they were helpless
the matter of becoming owners.

Coal Price Limitation.

From the facts given in the foregoing paragraphs may
traced the conditions that existed at the time representa-
ves of the gas industry (with their Allies in the matter—
e electricity industry, railway, tramway, water, dock, and
her interests) had conferences, arranged deputations with
e President of the Board of Trade, had meetings with
embers of Parliament, and came to the point where an
official Parliamentary Committee was appointed, which
sued certain recommendations on the subject—an espe-
ally important one being that [to which reference has
ready been made] regarding a limitation of the price of
al. The effect of all this spade work and persistence was
en in the discussions in the House of Commons on the
creases in the prices of public necessaries, and particularly
the discussions that took place when the President of the
oard of Trade introduced his famous Price of Coal (Limi-
tion) Bill, which gave Government recognition to what
e Board of Trade Committee had recommended—that an
sential like coal should not be (especially in times of
tional stress) without some form of control. The same
ing had been advocated before by Sir Corbet Woodall,
hen coal prices took considerable upward flight after the
al strike of 1912; and by Sir Arthur Markham—himself
coal owner—when early in the year startling market and
tail figures were showing themselves. Those who had
ade contracts prior to this were fortunate; afterwards,
e disposition was to defer making contracts in the hope
at the movement that had been inaugurated would result
the Government doing something effective. But some
uyers took fright, and made contracts at prices several
hillings above their last contracts. The upshot of it all
as the Price Limitation Bill; and congratulations are due
Mr. Runciman for the firm manner in which he piloted
hat measure through Parliament, and resisted the opposi-
ion of the strong coterie of infuriated coal owners in the
louse who saw their liberty of bleeding the community
hrough high coal prices in process of being effectually
rammelled; and they also saw in it something ominous in
espect of post-war freedom. A few Free Traders, too,
vere shocked at their principles being assailed; but their
rotests were couched in ineffectual words.

The chief feature of the measure as passed was that a
tandard price of 4s. per ton was allowed on the corresponding pithead rates of the year to June 30, 1914; it being calculated that 3s. would cover higher wages and additional colliery costs, leaving 1s. to meet exceptional cases. The 4s. increase means an enormous extra charge upon the nation. The President of the Board of Trade himself stated that 1s. increase on the home consumption of coal represented no less than £9,250,000 a year, and multiplying this by four, we have a startling figure. It means for the gas industry that the consumers of gas have to find for coal alone something like £3,500,000 extra a year. During the passage of the Bill through Parliament, a retrospective clause was inserted, which gave to local authorities and undertakers supplying gas, water, and electricity who had entered into contracts at high prices between April 1 and the commencement of the Act, the right to have the charges adjusted under the Act. Some gas undertakings within our knowledge had made contracts at 6s. to 7s. 6d. per ton higher than the prices of their preceding contracts. Recognizing the active and prominent part the gas industry had taken in obtaining statutory restriction, there was some fatuous retaliatory talk in the house, on the part of certain coal owners who ought to have known better, as to the residual products of gas undertakings being unlimited in price. But they got their quietus from Mr. Runciman, who pointed to the fact that divisible profits were limited in the case of gas undertakings, and those under the sliding-scale had to give the greater portion of their surplus profits to the consumers, before they could divide a small part of such profits among the shareholders.

Almost immediately after the Act came into operation, the coal owners tried their level-best to enter on a course of evasion by endeavouring to produce trouble by interpreting the Act in respect of the basis price in a manner never intended by the Government. The coalowners stated that they were advised by Counsel that the meaning of the words "the price of coal of the same description, sold in similar quantities, and *under similar conditions* affecting the sale at the pit's mouth, at the same coal mine, on the corresponding date," was that a day-by-day price was to be taken. The Lancashire Commercial Section communicated with the Board of Trade upon the subject; and the Board stated that, subject to special circumstances, "the corresponding price" would be "the price of coal sold under a contract corresponding to that under which the deliveries were being made." At the meeting of the Gas Companies' Protection Association, the Chairman (Mr. H. E. Jones) stated that the Association would be prepared to take up the matter if any of the members were inconvenienced by the coalowners insisting on their own curious interpretation.

However, this attempt at creating trouble having failed, the "Iron and Coal Trades Review" let out the secret of another possible movement, when it said in an editorial in November: "It would not be surprising if the collieries mainly dependent upon inland trade . . . sought some relief by applying to the Board of Trade, under clause 2 of section 1 of the Act, for permission to charge more than an advance of 4s. per ton upon corresponding prices."

Miners' Wages and a Strike.

In every section of the coal industry during the year, there was a largely prevalent disposition to make the very utmost possible out of the situation and the critical ordeal through which the country was passing. The burden of all the difficulties bore hardly on the whole community. The coal miners contributed their quota to the disturbance of things by exercising their numerical power in asking and insisting upon large consideration being showered upon them. They were not altogether to be blamed; they had before them the example of their masters. But the methods of the insistence of some were culpable—not in England, but in South Wales—for they jeopardized the country in the war and seriously threatened the continuity of our industries. Selfishness rode supreme.

Quite early in the year while other workers had almost generally conferred upon them something like a 10 per cent. war bonus, in respect of the higher cost of living, the coal miners—among the best paid men in the country—asked for a 20 per cent. war bonus. They held that the conditions were exceptional, and were not contemplated when the agreement under which they were working was entered into, which prohibited them asking for an advance before July. It was a long drawn-out business settling this matter. There were threats of a general strike if the 20 per cent. were not conceded. Mr. Runciman took the matter in hand; then the Prime Minister, to whom it was eventually agreed the points at issue should be referred. Mr. Asquith did not give much sympathy to the claim for a universal advance of 20 per cent. He agreed, however, that a *primâ facie* case was made out for an advance; but that the decision as to its extent should be left to the various District Conciliation Boards and Sliding-Scale Committees. The result was that all the miners in the federated area of England obtained a 15½ per cent. war bonus, which is equivalent to 25 per cent. on the old wage standard of 1888, and 17½ per cent. on the new wage standard. The men of Northumberland and Durham received 15 per cent. on the 1879 standard; those of Scotland, 18¾ per cent. on the standard rates of 1888; and those of South Wales, 17½ per cent. on the 1879 standard. Then in the English Federated area in November, a further advance of 5 per cent. was conceded. Taking the earlier advance—the 15½ per cent.—in the Federated area, the "Iron and Coal Trades Review" estimated that it meant only 7d. or 8d. per ton; but the colliery owners began to add to the price of coal a substantial sum to "cover" this. But as the margin was a liberal one, it meant still extra profit. The total costs that were put upon the coal owners through the war, it was variously computed, amounted to 1s. 6d. to 2s. per ton. Mr. Runciman, from the information at the disposal of the Board of Trade, calculated (this was in July) that 3s., including the bonus, more than covered the extra costs per ton; so that, as already stated, the 4s. standard supplied a margin of 1s.

There was the strike in the South Wales field, which lasted a week, and was a very mischievous business, for which both masters and men ought to have been thoroughly ashamed of themselves. In the same field, the men again ceased work in August, owing to differences of opinion as to understandings and interpretations in relation to the agreement upon which they previously returned to work; and since then there have been frequent disputes, and local cessations of work. We will not go over the details of this sickening business, which absorbed much time of the country and of Cabinet Ministers in trying to adjust affairs. But the spectacle of these men stopping work while their comrades, through love of home and country, were facing death at the front, and were waiting for more and more munitions and all that the homeland could give to help in the heavy work lying before, was one which completely closed national sympathy against them. Throughout the year, the coal-mining world has been in a sensitive condition; and those concerned in it appeared to be constantly pulling in contrary directions.

WORK OF THE COAL EXPORTS REGULATION COMMITTEE.

Allusion has been made to the establishment of the Coal Exports Regulation Committee, of which Mr. Russell Rea, M.P., is the Chairman. Acknowledgment must be made of the beneficial work accomplished by this Committee, which was not brought into being and operation a day too soon. The coalowners did not like it. There was a great deal of frothy talk as to the injury that would be done to the country through even the partial stoppage of exports to neutral countries, while at home supplies were deficient. It is wonderful how all the predictions of harm faded away with time. Soon after the war started, it was found that coal was going off at high prices to neutral countries in quantities unprecedented in times past; and much of the excess quantity of coal was not above suspicion as to its ultimate destination. The principle adopted by the Committee, in regulating the overseas coal trade, was the United Kingdom first, our Allies second, and then a very strict control over coal to neutral countries under the system of licences that was instituted. The stringency exercised as to licences had to be increased not only because coal was required at home, but on account of certain information which came to the knowledge of the Committee. The excellent effect of the work of the Committee was felt soon after it came into existence. While our Allies took more coal, and neutral countries could obtain less, the supply was materially increased for home use; storage began to assume normal conditions; ships for coastwise trade (in the summer months) were more plentiful, and home industries were generally able to breathe more freely. A few figures will be of interest. The quantity of coal exported in 1910 (excluding coal for shipping) was 62,085,476 tons; in 1911, 64,599,266 tons; in 1912, 64,444,395 tons; in 1913, 73,400,118 tons. In 1913, Germany took from us 8,973,920 tons. During the first year of the war—to July 31, 1915—the reduction in the quantity of coal exported, compared with the corresponding twelve months of 1913 to 1914, was 29,566,410 tons; but the Coal Exports Regulation Committee was only at work in the latter part of the first twelve months of the war. Since then, from Aug. 1 to Nov. 30 this year, there has been a reduction of 10,293,397 tons, compared with the corresponding four months of 1913. But, compared with the same four months of 1914, there has been an increase of 221,235 tons. But France has taken considerably larger quantities, and less coal has been allowed to go to neutral countries.

Gas companies operating in foreign lands, and who have hitherto been dependent upon British coals, suffered much not only from heavy freights, but—more particularly those at a distance—from the subsequent greater rigidity of control over exports. The British-owned companies in South America were acutely affected by the position. In Germany, gas-works that had formerly relied largely upon coal from this country had to turn entirely to German coals. Generally speaking, they do not appear to have suffered much in regard to supplies quantitatively; but some of them have done so in regard to supplies qualitatively. Certain of the coals delivered were high in their percentage of ash, and inferior in other respects; so that there was not complete happiness in respect of the quality of coke, which the community were advised, by high authority, should be used instead of coal. Holland furnished an interesting feature. For the control of the coal supplies, the Kolenbureau was established under the *ægis* of the Dutch Government; but in the Kolenbureau the Westphalian Coal Syndicate had more power than was pleasant for those Dutch merchants who were doing business with British coal. Information came that the intervention of the British Government was effecting the release from the domination of the Kolenbureau of those doing business in British coals; and then later there was a report that the Dutch Government were dissolving the Kolenbureau, and taking on themselves the control through a Committee, so as to free the coal position from German influence.

FUEL ECONOMY.

Before leaving the subject of coal, there is another important question that has been projected well into view during the year which should be mentioned—that is, fuel economy. Through the periods of cheap coal, this country has grown most prodigal in its native primary resource; and progress and science have proved that the utmost use is not being made of the coal expended. It is one of the foremost of economic questions. Good service was rendered by Professor W. A. Bone, F.R.S., by introducing the topic at the meeting of the British Association this year, and giving to it a prominence that it much required, especially at this time, when there is so much being said as to the organization of our resources, and the improvement of our economic position. Waste overshadows the use of coal in every direction, but least, Professor Bone acknowledged, in the gas industry. He pointed to the waste in the domestic fireplace; but industry received his particular attention, and the coke-oven industry offered him illustration of promptly preventible waste. The beehive oven is a spendthrift of a disreputable order between coal income and coke product; and the bye-product plants are not, in the main, doing all they might do if proper chemical control were exercised over them. A Committee of scientists and technologists has been appointed by the British Association, through the instrumentality of Professor Bone, to investigate the question; and the Committee has power to add to its number by the selection of men whose knowledge of industrial matters will be helpful. The Committee should prove of national benefit. In the electricity industry, there is room for fuel economy by the greater extension of the employment of gas coke; and to this matter Mr. E. W. L. Nicol, the technical expert of the London Coke Sales Committee, has drawn attention. The British Commercial Gas Association lately appointed an Industrial Fuel Committee.

OIL.

There is little to be said about the oil position. Oil has considerably advanced in price in common with coal, owing to freights, the shortage of tank-steamers, and the general ward tendency of all commodities. Gas companies who l contracts running under pre-war prices, or entered into ore the shipping position made such an enormous differ- e in the situation, found themselves for a time in a y favourable position for making gas just as was best culated to alleviate financially the abnormal conditions. veral concerns had oil in store at about 4d. per gallon, ich was bad enough; but just lately they have been ng out this oil, with quotations (at the time of writing) nding at about 7d. per gallon. According to official re- ns, in 1912 the various petroleum products imported ounted to 413,333,358 gallons; in 1913, to 488,106,963 lons; and in 1914, to 459,744,780 gallons. What the ures are likely to be for 1915 we have no information; t the complaint as to shortage of tank-steamers and the resentations made to the Admiralty on the subject, lead e to anticipate that the imports will exhibit a decline. owever that may be, the huge companies trading in oil em to have had a very comfortable time, judging from fact that the Shell Transport and Trading Company d a dividend of 35 per cent. for the last complete year's ding, free of income-tax. The same Company have just id an interim dividend for the current year of 10 per cent. e of income-tax, and state that, when the complete counts are presented, there is reason to believe the results ll not be inferior to those of the previous year. The last ost important appearance made by the late Professor vian B. Lewes at the Royal Society of Arts was in con- ction with oil—"Motor Fuels" being his subject. Users Diesel engines are feeling acutely the current high prices oil fuel.

Residual Products—Coke.

The year has made one thing certain. It is that the gas dustry is acquiring a new position in connection with its sidual products; and the war has helped in the move- ent, through the shutting-off of supplies from Germany of rtain necessaries to this country, the requirement of the untry for more and more explosives, the cry for national onomy, and the need for supplies of sulphate of ammonia r those markets in which Germany was operating before e found the British Navy an impediment in the path of r overseas trade. If the gas industry does not make the ost of its present opportunities for consolidating its resi- als position by organized effort, then it will show a de- ciency of foresight. In a previous paragraph, reference as made to the London Coke Sales Committee and their pert Mr. E. W. L. Nicol. Our columns have shown that e work Mr. Nicol and the Committee are doing in estab- shing broader foundations for coke use (together with the ritish Commercial Gas Association) is of inestimable alue for the industry. A gas engineering contributor to r pages who makes a special study—technically and com- ercially—of this branch of business has also done excel- nt service. The result of the co-operative effort, com- ined with local endeavour, is that more and more steam- oilers are being fed with coke, and more and more are eing fitted with stoking appliances and forced draught, order that coke may be used under them. But a good tandard of purity for gas coke is required; and for the urpose it must be graded to proper size, on which points uch information has appeared in our columns during the ear. For motor buses and motor lorries, there has been pplication which shows that fuel costs with coke are lower er mile than when using Welsh coal or oil. In America, oke breeze is being used for locomotives on the Baltimore nd Ohio Railway; and the results are said to be as good, ith strong and forced draught appliances, as when using ow-grade coal. Information has been given in the various rticles we have published as to the evaporative power of oke and breeze; and for Scotch breeze figures have been upplied by Mr. W. R. Herring. There was some discus- ion in our columns as to the price at which coke breeze hould be sold to electricity generating stations; the view eing expressed that the full value of the breeze as a steam- aising agent should be paid, while, on the other hand, the pinion was held that an eye should be kept on the future when the fuel would not be so scarce as now, when prices would be lower, and when fuel competition would be keener. One matter about which some steam-boiler users have been extremely doubtful has been as to whether coke would have a greater deleterious effect upon their boilers than coal. Meldrum's Limited contributed to our columns important testimony on this point. During the past thirty years, they have fitted thousands of boilers for burning coke fuel; and, during this period, they have never heard of any deleterious effect on the boilers themselves. Boilers fitted with their furnaces twenty-five years ago are still in operation, and are working efficiently.

Before the London and Southern Junior Association, Professor Lewes again advocated low-temperature carbonization, in order to increase in the coke the average proportion of volatile matter to 4 or 5 per cent., which would, if commercially practicable, be a material improvement so far as the open grate is concerned. But Mr. Nicol subsequently pointed out that there would be no corresponding decrease in the proportion of ash in the coke, the presence of which is as much cause of its sullen behaviour as is the low percentage of volatile matter. It is doubtful whether any commercial advantage would be gained by adopting Professor Lewes's suggestion, in view of the loss of business in other directions; for the baker and horticulturist, for instance, the amount of volatile matter in coke as now produced is quite enough.

The free sale of coke, owing to the manner in which coal supplies were hung-up, and the high market and retail prices commanded for coal, caused effort in the local development of custom to slacken considerably. In the early part of the year, demand was great throughout the country; and those undertakings that had motor lorries available for the work experienced their commercial advantage, through quick distribution and the larger delivery radius they gave them. In London and some of the large centres with a considerable poor population, queues of poor people were in the latter part of the winter of 1914-15 to be seen outside gas-works early in the morning waiting for small supplies of fuel. In some districts, too, coke supplied in 14-lb. and 28-lb. bags was very popular. Though the cultivation of local demand is all-important—looking at past experience and in anticipation of history repeating itself after the war, inasmuch as the production of coke is more likely to increase than lessen —there are some gas managements that still prefer not to be troubled with small local transactions. No doubt in consequence of this antipathy, or partly so, there was an amount of complaint at different Association meetings as to raids by gas undertakings with coke into other gas-supply districts—sometimes situated quite a distance away. There were complaints from the Eastern counties and from Scotland; and at one of the meetings of the Lancaster Town Council, it was asserted that the price of coke had had to be reduced owing to competition in the town by other gas undertakings. It was found too that certain gas undertakings represented in one Commercial Gas Section competed in the areas of gas undertakings represented in another Commercial Gas Section. This is leading to dissatisfaction. Gas-works in the north-eastern areas especially have developed a large coke trade abroad. Mr. Thomas Waddom, in his Presidential Address to the North of England Gas Managers' Association, stated that in the previous two years no less than 74 and 68·8 per cent. of the coke production of the Newcastle and Gateshead Gas Company had been exported. He complained of the restrictions to export which have been placed upon coke by the Coal Exports Committee, as did also Mr. A. W. Branson, of Hartlepool, in his Presidential Address to the Welsh Gas Association, to which office he was elected before his transfer northward.

Reverting to the domestic use of coke, less was heard during the year of installations of coke boilers for hot-water. But excellent experiences of coke as an economical agent. for this purpose are being obtained; and it is only a case of suspended animation that more has not been heard of developments this year. There will be a revival after the war. Dr. A. Vernon Harcourt, F.R.S., gave, at the Royal Society of Arts, some interesting experiences as to personal use of coke in specially designed grates in the rooms of his own house. A good amount of attention was devoted to the utilization of coke dust for briquette making. It was a point at the Cardiff Trade Development Conference; a plant, it was reported, has been ordered for the Smethwick Gas-Works; and in our columns appeared accounts of what was being done in this regard at the Kolberg and Nuremberg Gas-Works.

There is little use referring specifically to the prices obtained for coke. They varied so much according to local circumstances. But prices (which recovered well towards the end of the second half of 1914) were good in the earlier part of the year; and for years stocks have not been so low at June 30 as they were this year—in fact, many works in the earlier part of the first half frequently found themselves with clear yards. But during July, August, and September stocks again began to accumulate in some districts. This was only natural. Prices went up considerably; and they continued to rule at high levels in common with coal. In the autumn, manufacturers and other large users of coke commenced once more to stock preparatory for the winter; and in the closing months of the year, especially when the cold weather set in, local demand again ascended. The coke business was one which during the year gave little concern, which is an experience that has not been the lot of the industry for some years.

According to the prices, f.o.b. Tyne, given by our Northern coal trade correspondent, the year started at from 11s. to 12s. per ton; but prices did not make the same sharp ascent in the spring as did coal. They moved up gradually till in May and June 19s. to 20s. ruled. By August 26s. to 27s. was quoted; and until the end of the year prices varied between these figures and 30s.

Tar, Dehydration, and Toluol.

For several reasons, tar, like coal, has been in great prominence during the year. It has taken a place among exigent national requirements that has given to it an unaccustomed status. Producers wish this status applied also to the commercial position of the product. The former condition is due to the requirement for benzol, toluol, and other products necessary to the manufacture of explosives, and to the need for intermediate products for dye and colour making. But the tar market generally was not in good form, owing to the dropping-off of the foreign demand for pitch principally for briquette making, and the impossibility of shipping pitch owing to the high freights. As a matter of fact, pitch at the price at which it could be delivered abroad put briquette-making other than with local materials entirely out of the range of practicability. As already mentioned, briquette-making has been the subject of much consideration at home; and this may become a new branch in gas-works operations, as in several places on the Continent. The matter was particularly emphasized by Mr. W. J. A. Butterfield, M.A., F.I.C., in a paper that he read at the Cardiff Trade Conference. Early in the year, it was announced that the Yorkshire tar distillers and producers had arrived, shortly after the outbreak of war, at an amicable understanding on the subject of pitch. Under the arrangement, pitch was not to be sold at less than 34s. a ton without the consent of the tar producer, and a sum approximately equal to the value of the liquid products was to be paid on account of each ton of raw tar delivered. But this arrangement was not a general one. Stocks of pitch continued to increase considerably; and the prices that were commanded fluctuated largely according to conditions—so much so that between quotations and prices actually obtained for the material (say, as between London and the provinces) there was such wide divergence that much trouble with buyers and sellers soon ensued. Another thing that was against tar was that road authorities, owing to the financial conditions and the need for economy, refrained to a very great extent from their annual custom of tar-spraying roads, and the stoppage of grants by the Road Board (whose funds have been temporarily diverted to other national purposes) did not encourage the work. Moreover, the use of crude tar on the roads was forbidden. The result of this was that refined tar was not in some cases, owing to the absence of dehydration plants at gas-works, locally available, and to obtain it from distillers would in many cases have meant considerable cost in carriage. Notwithstanding the prohibition as to the use of the crude tar, it came to the knowledge of the Ministry of Munitions that a quantity was being employed; and, towards the end of the year, Mr. H. P. Maybury, the Manager and Engineer to the Road Board, issued circulars urging obedience to the instructions.

It happens that the requirements of the Ministry of Munitions in respect of tar fit in well with the provision of the most suitable tar for road purposes. The application of the "C" process for increasing the quantity of benzol and toluol in tar by washing the gas has resulted in a considerable development in the treatment of tar in gas-works, by the adoption of first-stage tar distillation or dehydration. The temperature at which distillation has to be carried on to comply with the order that the whole of the toluol should be removed from the tar along with a quantity of the phenols is just that which causes the tar to comply with the Road Board's specification for road-dressing purposes. Had i not been for this large adoption of tar dehydration in gas works, the tar distillers would have had difficulty in meeting the huge demands for toluol made by the Ministry of Munitions. However, this development in tar dehydration has brought under reconsideration the question of going further in the process by adopting the next-stage process of rectification and fractionation of the light oils; and additional gas engineers have commenced to debate in their own minds the matter of adopting complete tar distillation. The proposal has also been made that groups of gas-works should combine for carrying on independent tar distilleries; and more may be heard of this ere long.

It was quite early in the year that the War Office placed restrictions upon the sale of benzol; and from this point started the developments for increasing the supply of toluol beyond that available from the production of tar in the United Kingdom. Dr. Harold G. Colman, in his advisory capacity in this matter, published descriptions of methods for determining the amount of toluene in tar; and then came the discussion, at first largely *sub rosa*, as to the preferable methods for washing gas in order to secure a larger supply of both benzol and toluol. Supply was imperatively demanded. Germany had during years accumulated a large stock of the requisites for making high explosives; and Professor Vivian B. Lewes stated (and he was in a position to know) that, at the beginning of the war, there were only about 20 tons—certainly not more than 50 tons—of trinitrotoluene on the English market. It was a serious position in which this country found itself, when Germany had made high explosives a paramount essential in the war. The gas undertakings came to the aid of the country in an extremity produced entirely by past neglect; and what the gas undertakings have done is rather a striking commentary on the action of the chemical manufacturers and the Private Bill authorities in trying to reduce the mobility, efficiency, and economy of the industry in the matter of dealing in and working-up its own secondary products. First of all, there was discussion of the oil-washing processes of Dr. W. B. Davidson and the Gas Light and Coke Company. It was found in connection with the former that by prebenzolizing the wash oil—using about 5 per cent. of 90 per cent. benzol—the effects on the illuminating and calorific power of the gas were negligible, though nearly 80 per cent. of the toluol was removed from the gas. This has been proved true time after time in the experimental work that has been carried out. With the Gas Light Company's process, it was found that, by careful selection of the wash oil, and proportioning the quantity of oil to the volume of gas to be treated, there was (without prebenzolizing) very little injury done to the gas. But these oil-washing processes mean special plant. Then came the "C" process, which any properly equipped gas-works, with a spare scrubber and pump, can adopt. The process is not so efficient quantitatively as the oil process; but its charm, under the circumstances, is that it can be readily adopted by gas-works, without much cost, and be at once put to work, and so make immediate contribution to what was, and is still, urgently required. The experience with the system has been an education. It has been found that the benzol content of gas from English coals of comparable quality increases as they go South—that is to say, the highest content is found in Shropshire and Derbyshire and some South Yorkshire coals. The yield of toluol per ton of tar, using the "C" process, of course varies not only with different coals but with methods and temperatures of carbonization, and the amount of supervision that is given to the working of the process. More might be done in improving yield by many works operating the process, though no gas undertaking can hope to reach the 7 gallons of toluol per ton of tar that was found in one consignment from the Valley Road works of the Bradford Corporation. This was extraordinary; but more ordinary figures are from (say) 2·5 gallons up to a gallon or so higher. Various other proposals were made and discussed in our columns for increasing the yield of toluol—lower temperature carbonization and the use of limestone as a catalyst being among them.

Gas undertakings were asked to operate for maximum yield; and more works were required to take up the process. A great number of the smaller undertakings did not immediately respond; but more and more, in a position to do so, are coming into line. In the autumn there were about 600 gas-works operating the process; and still the cry was for "toluol, more toluol." Many of the undertakings took up the work quite patriotically; others hung back—we hope only because they did not thoroughly understand the position, and not because they were not assured as to whether there was profit in it for them, or because they did not wish even in this respect to be put out of their ordinary routine. But the country's interests in this war are supreme; and circular-letters were issued early this winter requiring, under the powers conferred by the Defence of the Realm Act and the Ministry of Munitions Act, the recipient gas undertakings to wash their gas to extract the benzol, toluol, xylol, and other constituents. At the same time, gas undertakings were relieved of forfeiture for any lapses from the obligations as to illuminating power or calorific value. Local authorities were asked to do everything possible to protect gas undertakings from attacks in the event of their gas exhibiting any deterioration in view of what they were doing in the national interests. Some local authorities showed their "appreciation" of the meaning of this by talking of the communications in public; and the Bristol Sanitary Committee topped the request of the Ministry of Munitions by publicly talking of some *quid pro quo* for the consumers in respect of any infringement of statutory quality. So much for the appreciation by these people of the situation and of the inviolable priority of national obligations and duty. This publication also started some mild agitation among small bodies of consumers for reductions of gas prices—all due to a misunderstanding of the position.

In connection with the High Explosives Department, Mr. W. Doig Gibb has been retained to act as technical adviser at headquarters. Quite a number of gas engineers, too, have given their services voluntarily in the position of District Inspectors in order to keep an eye on the operation of the recovery process, and to assist in the development of supplies. There has been excellent keenness shown in this matter.

One trouble arising from the working of the "C" process which the setting-in of cold weather accentuated was that of naphthalene deposits. The process has the effect—providing the temperature is right, and the tar is not supersaturated with naphthalene—of reducing the number of grains of naphthalene per 100 cubic feet of gas; but, owing to the amount of light oils extracted from, and thus the change in the constitution of, the gas, with the coming of cold weather some difficulty arose. Other causes may have contributed to the trouble, as discussed in an article by Mr. Thomas Glover in our columns a fortnight since, when he also suggested remedies for the trouble—such as the introduction of vaporized oil to the gas, or washing the gas with water gas tar to reduce the naphthalene.

Another difficulty was with some of the tar distillers, who did not evince any great alacrity in giving gas undertakings full credit for the greater value of the tar sent to them from works operating the "C" process, but not a tar dehydration plant. This was a matter that was fully dealt with in an article, headed "The Market Value of Light Oils and Other Constituents of Tar," which appeared in the "JOURNAL" for July 20.

Interest was aroused in an announcement from America that Dr. Walter F. Rittmann, the Chemical Engineer to the United States Bureau of Mines, had invented a process for the production from crude petroleum of supplies of material for making dye-stuffs and explosives. There is nothing new in recovering the essentials for dye-stuffs and explosives from petroleum; but Dr. Rittmann claims to have exceeded anything that has been done before. Interest is whetted; and further information is awaited.

With regard to the applications of tar, the President of the Iron and Steel Institute, the late Dr. Adolphe Greiner, presented a note at the annual meeting upon the heating by tar of an open-hearth furnace. Using a 12-ton furnace, so good were the results (as reproduced in the "JOURNAL") that at the Cockerill works at Seraing, Belgium, a new 25-ton furnace was built, furnished with appliances for the exclusive utilization of tar as the fuel.

THE SUPPLY OF DYE-STUFFS.

While on the subject of tar, the question of the supply of aniline dyes and colours may be referred to. Preceding the war, the aniline dyes annually used in Great Britain were valued at approximately 2 millions sterling, of which less than 15 per cent. were produced in this country. Soon after the war started, it was realized that important industries of this country would be crippled for want of dyes and colours unless immediate steps were taken to supply them. Germany had been the country that had governed in this manufacture and trade, and upon that country we had largely relied for supplies. However, Germany was put out of the field as a supplier; and the British industries concerned, led by the Government, turned attention to see what could be done in the way of providing requirements by developing home resources. Some of the larger gas undertakings immediately entered into the work of helping to rescue the country from a disastrous position by putting down plant for obtaining intermediate products.

Then came the great dye scheme, promoted by the Board of Trade, in which the Government are largely financially interested, and for which they are finding £100,000, spread over ten years, for research. The idea was that the greater part of the capital should be found by the users of the dyes, and that the Government should for the time being supply a definite proportion. The details are to be found in the year's volumes of the "JOURNAL." But a strange thing about the scheme is that it was all but wrecked by the very people for whose benefit it was primarily proposed, and whose businesses would have gone to the wall had a scheme for the development of home production not been matured. It looked at one time very much as though the scheme would fail; but thanks to the persistence of the Board of Trade and those who had worked with them in the matter, British Dyes, Limited—being a modification of the original project—was launched. Before this, however, there was talk of free trade and protection; and these old political fetishes were held up and worshipped, as though this was not an occasion when the need for the country helping itself was superior to any political principles. But there is no necessity to traverse the old ground again about which hopes and fears were plentifully strewn. Suffice it, the scheme is in actual existence, and is being developed on systematic lines. In connection with it, Dr. W. B. Davidson, late of the Birmingham Corporation Gas-Works, has been appointed Chemical Engineer. The works of Messrs. Read Holliday and Son, at Huddersfield, were purchased by the Company; by July their capacity had been nearly doubled; and developments are still proceeding. Good relations, too, have been established with the Swiss producers. The research department was (according to the latest information) being founded; and Dr. G. T. Morgan, F.R.S., of the Royal College of Science of Ireland, has been invited to become head of the department. An Advisory Committee has also been constituted. Thus the country was in this respect well before the end of the year in a happier position than it was in at the beginning of the year. The technical and business men at the head of affairs ought to secure the country in respect of dyes and colours; and between the Company and the loyalty and co-operation of users, Germany should find itself, when peace is declared, no longer wanted for a very large part of the dye and colour business. Meantime, America is also extending its productive capacity; so that Germany will not in this regard be in such big request after the war as before it.

SULPHATE OF AMMONIA AND NITRATE OF SODA.

Through the street and shop lighting restrictions, and domestic economy, although in industrial areas the consumption of gas rose considerably for munition work, there is little doubt that, taking the country through, the amount of coal carbonized by gas-works (during part of the year a larger amount of water gas was produced in many cases) has been diminished; and so the quantity of residual products has likewise suffered diminution. In the fore part of the year, Messrs. Bradbury and Hirsch estimated a fairly considerable falling-off during 1914 (including five months war) in the quantity of sulphate of ammonia produced; and when the report of the Chief Inspector under the Alkali Works Regulation Act (Mr. W. S. Curphey) appeared, it was seen that the returns at his disposal placed the reduction by gas-works for the year at about 5000 tons. The position of this product has been, and is, an interesting one. It is a secondary product that depends largely upon overseas trade; and it is a product that is commercially threatened more than any other. Unless steps are taken to establish British interests in it firmly in the foreign markets while Germany is out of competition, we may, when peace again reigns, see our production suffering a heavy set-back. Never was an Association more needed than is the Sulphate of Ammonia Association to-day; and some sound advice has been distributed by them, by circulars and through papers at the different Association meetings, as to what makers must do if they are to meet the German competition. It is easy enough to-day to say: "All is well." The point is, Will all be well after the war if proper steps to protect British sulphate of ammonia are not taken with the universal support of the makers?

The position is this: Germany's production of sulphate of ammonia was prior to the war increasing by leaps and bounds from gas-works, coke-ovens, and through the synthetic process; and the German Sulphate of Ammonia Association were developing the markets abroad by very systematic and telling ways. The chief method was a guaranteed 25 per cent. ammonia product, and selling at a lower price than British 24½ per cent. ammonia sulphate! The British production was, well before the war, already seriously feeling the competition; and it had been practically driven out of the Continental markets. What was happening was the *raison d'être* for a strong Sulphate of Ammonia Association here. Methodically, the Association has been at work. But some producers do not seem to take the competition of Germany seriously; and the Association find themselves faced with the difficulty of converting the unbelievers. They should mark well the statement in the report of the German Sulphate of Ammonia Association, that, "notwithstanding the interruption produced by war complications, the Association have resolved to maintain the activity of its foreign offices so far as possible, in order to extend and strengthen the possibilities of sales after the conclusion of peace." The 25 per cent. ammonia quality is now asked for abroad; and among the advice of the British Sulphate of Ammonia Association is that all our home makers should produce what is wanted abroad, and that is the 25 per cent. quality, and containing not more than 3 per cent. of moisture and ½ per cent. of free acid. Against this prescription short-sightedness has been showing hostility, as though the sole arbiters in the matter are the British makers, and that buyers have no say in it, nor the competitors of Great Britain for the trade. Then there is, in addition to synthetic ammonia, and (in normal times) increasing production from gas-works and coke-ovens, the production of cyanamide or Norwegian nitrate of lime. The nitrate of soda importers also see reason for being more than ever on the alert. Although the Nitrogen Products and Carbide Company have so far disappointed the shareholders, we had the Societé Norvegienne de l'Azote reporting gross profits of £468,000 for 1913-14, compared with £442,000 in 1912-1913, and net profits of £316,000 and £287,000 in the two years respectively. This does not look like phantom competition. However, the German competitors in the foreign markets have set the pace; and so this country has to counteract it. In order to keep abreast of them after the war, our Sulphate of Ammonia Association will want its intelligence and selling systems well organized.

Regarding home trade, the advice has been given that the services of the corn factor should be developed in doing business. There again, though the corn factor is a person of influence with the farmer (to whom the Board of Agriculture have appealed to increase the production of his land, which ought to benefit all fertilizers), there are some sulphate of ammonia makers who begrudge him a fair profit on the business he does, and so turn his interest in favour of other fertilizers. The Association also propose a method for avoiding violent fluctuations in the price of sulphate of ammonia, which are an abomination in the eyes of the agricultural merchants. Firmer prices can only be realized by producers refraining from spoiling each other's markets by competing and underselling, and by giving longer tenure to prices. The proposal is for prices to be fixed monthly in given districts by a local committee of producers for 24½ per cent. and 25 per cent. ammonia. Expediency and not political principles must govern in a case such as this. The sulphate of ammonia makers cannot afford to neglect any opportunity for consolidating their commercial position; if they do neglect their opportunities, they will regret it. It may be added here that in connection with the war, the Association entered into an agreement with the Board of Agriculture as to the reservation of a quantity of ammonia for home use, and as to the price to be charged for it.

Regarding the prices of sulphate of ammonia, the average figure in 1914 was £11 7s. 1d. per ton, which was less by £2 0s. 5¼d. than in 1913. But in December, 1914, the price was upward bound, and reached over £12 per ton. This year has seen prices by easy gradations pass from about £12 to the neighbourhood of £17, with only small reversions from the upward course. One would have to go back a long way to find business at such prices. The report came from Germany that early in the year £13 10s. per ton was being obtained in the Elbe District for 25 per cent. ammonia quality, and £13 15s. for 25½ per cent.; while east of the Elbe about 5s. per ton above these prices was being paid. Legislation was proposed in Germany to create a nitrogen monopoly there.

In his annual report, under the Alkali Works Regulation Act, Mr. Curphey stated that he and his staff found a distinct tendency to a higher standard of working in connection with sulphate of ammonia production—partly through the economy and larger yields effected by the preservation of ammonia in dealing with the storage of liquor, partly owing to the adoption of improved plant, and partly to closer attention to details generally. The report also called attention to the incipient adoption of the direct process of recovery on gas-works; and with such adoption Mr. Curphey anticipates higher yields per ton of coal. He also counsels the application of more scientific control to this work. Within the past few weeks, Mr. Curphey has added to the indebtedness of the industry to him by publishing the results of some trials made as to the preservation of ammonia by having a thin film of suitable oil on top of stored liquor. The saving is remarkable [see "JOURNAL," Nov. 23, pp. 419, 424.]

Among associated miscellaneous matters, there was difficulty with supplies of sulphuric acid; a scarcity having arisen through the extraordinarily large amounts that were being used in steel works, wire works, and explosives manufacture, &c. Prices went up; and the quality of acid available to some makers did not assist them in producing sulphate of good colour. Attention was now and again directed to the question of the production of liquid ammonia. Not much was heard of the beet-growing experiments in this country; but such news as came to hand was satisfactory. Professor Bottomley, of the University of London, introduced to the notice of the British Association a new fertilizer, produced by the treatment of peat with bacteria. The result is said to be about fifty times more valuable than farmyard manure. During the year, there was issued the final report of the Royal Commissioners appointed to inquire into the methods of treating and disposing of sewage; and in part it dealt with the question of the discharge into sewers and streams of spent liquor from gas-works. The Commissioners did not appear to possess any very definite knowledge on the subject of the purification of spent liquor.

There has been a distinct drop in the importation of nitrate of soda during the year; so much so that the position has created some alarm in the House of Commons, and has given rise to questions there. The Parliamentary Secretary to the Board of Agriculture in November stated that there would be a considerable shortage, unless steps were taken to supplement the supply. Then the total amount of nitrate of soda in this country or on its way was only about 30,000 tons, while the ordinary consumption per annum was reckoned at about 120,000 tons, of which it had been estimated that about two-thirds or rather more are used for fertilizing purposes. There is no evidence that the consumption has shown any material increase during the past ten years. Prices have moved up in the course of the year from 10s. 2d. per cwt. for ordinary quality and 10s. 6d. for refined to about 14s. 10d. to 15s. 10d. respectively.

GAS TRADING AND OTHER EXPERIENCES.

Thus we see that with coal, its conveyance, and the secondary products of its carbonization, the old conditions have given place to new—some of them of only temporary character; others, we trust, of permanent order. The industry has in short been working with an altogether fresh environment; and it has faced the situation well, and evinced anew its great vitality. Searching high or low, one could not find a better or more concise statement of the position for gas undertakings than Sir Corbet Woodall, D.Sc., gave at the meeting, in February, of the proprietors of the Gas Light and Coke Company: "There is nothing," he said "in the situation to shake our confidence in gas and in the Company. I say—not as a matter of peroration, but in sober truth, capable of proof by facts and figures—that while our difficulties and disappointments are temporary and cidental, our financial and commercial strength and sta- ility are permanent, and have been husbanded, developed, nd extended for years past, so that we are thoroughly well ound and equipped for weathering the storm that assails s, from so many different quarters at once." These words pply, practically speaking, to the whole industry; and the roof of their truth is found in the conditions at the end of e year. And this notwithstanding the bad business prin- iples and conditions, external to the industry itself, which eighed heavily upon its fortunes, and in which conditions e Government had concern, as portrayed by Mr. Charles arpenter at one of the meetings of the South Metropolitan ompany during the year. The administrative ability of e industry, and its technical talent and executive capacity, ere put to the strongest of tests, unprecedented in their any phases; and in no respect was the one or the other ound wanting. Coal and oil deliveries, prices, conveyance, nd the markets for residual products, gave (as already seen) ause for grave concern; and on the manufacturing side e bearing of each of the factors making up the strange ituation had to be carefully weighed in order to ensure the est return to the undertakings—this especially where the bility to change the proportions of coal and carburetted ater gas existed. The quantity of coal in store, coal prices, il prices, and the sales conditions of coke and the other pro- ucts were factors in judgment, and important ones in the atter of financial result, as will have been seen by what as preceded.

Upon the managements came not only the requirements s to the production of both benzol and toluol; but the gas- rading conditions were entirely changed, so much so that the ircumstances of one concern in this respect has no relation o those of another concern. This makes general figures f no use whatever to show the conditions of the industry enerally. For example, take the between 4 and 5 per cent. eduction of consumption of the Gas Light and Coke and outh Metropolitan Companies, just over their borders here were in the suburbs increases in some cases, small ecreases in others, while in many big industrial centres in he provinces, through the work on munitions, there were umping consumption increases, so much so that Birming- am had twice to ask the ordinary consumers to be frugal n the use of gas during the depth of this winter, as the re- uirements of the factories must be met. Where there were decreases, they were, of course, due to the necessity for ighting restrictions in streets and shops, particularly in the London area and along the eastern and southern coasts, and in inland towns and places that might particularly court the ttentions of the enemy in the prosecution of the Zeppelin mode of warfare. The wisdom of the precautions taken to bscure cities, towns, and smaller places within range, was proved, for Zeppelins occasionally came when conditions were favourable, and the lives of civilians were lost and property suffered destruction. The obscuring of lights in private dwellings was also insisted upon; and this, with the more rigid economy that private residents were induced to practise—through the compulsion of increasing expense, and through the need so constantly preached for national thrift in order to finance the war (the country's expenditure during this time amounting in the aggregate to the enormous sum of about five millions a day)—also caused reductions in private consumption. In connection with industry in areas in which considerable work was proceeding, it was the large demand for heating gas-furnaces, for power, and for lighting during night work, that caused such immense demand—a demand that in some instances moved about erratically between high and low figures in a manner which exercised severely the wit of many engineers to keep pace with the changes of requirement. There was also very large consumption in some areas for hospital and camp use—for cooking, heating, laundry work, and lighting. Under the circumstances, one cannot, in a retrospect, say anything specific as to consumption that will generally show the conditions of the industry in this regard. Comparison is defied by circumstance, and circumstance of an artificial character. But in connection with consumption, there was a grievance; and it was that while the Government asked so much of the gas industry in connection with keeping up supplies of gas, and providing necessaries for making explosives, and other things, they showed no reciprocity, either in the matter of facilitating the raising of capital for the industry's work, or of spending money with the industry, or (for a long time) in helping it to provision itself with raw materials. There was something very one-sided about all this; and representation was made to the Government on this head, through the Ministry of Munitions, by, jointly, the Institution of Gas Engineers, the Society of British Gas Industries, and the British Commercial Gas Association.

Another condition which bore heavily upon the financial results of trading—in addition to the price of coal and oil, the cost of carriage, the varied conditions of the markets for residual products, and of gas consumption—was labour. The industry, generally speaking, has lost a considerable number of its regular works and district hands, and members of official and clerical staffs—many of the men being skilled, and therefore difficult to part with in the interests of the concern. They joined the Army and Navy, and went off to munitions works. But the recruiting proceeded to such an extent that fears arose as to the ability to meet maximum demands in the depth of winter, although men less efficient, some of them raw to the work, were drafted in from outside. The same deficiency of men existed in the district, to an extent that made it impossible for any efforts at development to realize their full measure of result in actual business, seeing there were not the men to cope promptly with the new orders. It was necessary that, if the gas industry was to comply with its many obligations—if the safety and convenience of the community were to be assured through the gas supply, if industries making large demands upon gas-works for munition and other work were to be satisfied—the process of depletion of the industry's men would have to be stopped. The matter was frequently discussed—one occasion being the meeting of the Institution in June. The Institution made representations to the Government authorities on the subject; but for a long time there were no really satisfactory assurances. Towards the end of the year, however, gas-works service was listed among the occupations that were of cardinal importance to various other branches of trade and industry; and it was authoritatively stated that skilled men in such undertakings, if attested and classified in Section B (Army Reserve), would not be called up for actual service with the Colours unless their employers stated that their services could be spared. With regard to men applying for munitions work, the Ministry of Munitions gave an assurance in the case of men enrolled, that an opportunity would be given to employers to say whether or not the men were engaged upon essential work. The supply of badges for indispensable men to wear was also (for a long time) the subject of much discussion, and of equal disappointment through the reluctance of the War Office to do anything, or to give countenance to anything, that would be a hindrance to recruiting. Eventually, however, there was an issue of official badges to skilled men engaged upon the washing of gas for the recovery of toluol, and to the men engaged within works supplying gas in munition-producing areas. As most gas-works, other than small ones, could claim to be doing work of this character, the number of men qualified to wear badges was a fairly large one. In regard to those men who had enlisted, the generosity of the industry in the matter of wages, and assistance to dependants, of course, meant a fairly considerable additional charge upon the year, specially due to the war. The war bonus, too, to the men remaining at work also formed an item of some weight. Several undertakings had this year greater recourse to the assistance of women in clerical work, in meter reading, in burner maintenance, and in show-rooms.

The greatly increased costs, combined with diminished income, led many undertakings in the final quarter of 1914 to raise the price of gas; and their expenses still moving upward for coal and other material and goods, with augmented outgoings in other directions, necessitated, in not a few cases, a second advance in price in the early part of the present year. Most of the undertakings, too, that had not earlier felt the need, through large reserves or other special circumstances, to supplement income by raising the price, had to take the step this year, with the result that there are few (if any) undertakings that have not made an advance. Here, again, there was no general rule, nor could there be one, as to the amount of the advance. It depended entirely upon individual circumstances. There were some municipal concerns that could well have done without increasing the price, or to a less extent than they did advance it, had they not desired to have their full "pound of flesh" in the shape of profits in aid of the rates. A better illustration of gas consumers having to bear an undue proportion of the requirements of the local exchequer, there could not be—gas prices, in this time of stress, having been actually raised in order to provide money to aid the rates for matters unidentified with the gas service. However, speaking generally, there is not much likelihood of gas undertakings, even with the increases of prices made, showing any excess profits arising directly from the war which can be taxed in the manner proposed by the Chancellor of the Exchequer, and as has been authorized by the Finance Act. In connection with sliding-scale companies, the increase in the price of gas affected the dividend in proportion, and in some cases where increases were heavy, very substantially; and this, combined with the increase in the income-tax, gave the return on capital an unaccustomed lightness.

We have refrained on this occasion from specifically mentioning any undertaking or giving particulars, seeing that individual experiences are so unrepresentative, even approximately, of the whole. But if one undertaking should be mentioned, it is the Alliance and Dublin Consumers' Gas Company, which showed that—through the expert advice, and the work that is being done by the Consulting Engineer (Mr. William Newbigging), and the officers, under more intelligent administration—it was well on the recuperative road; so much so that the proprietors, liberally inclined, made a present of £1000 to the three new English Directors, and added for their benefit £500 a year to the sum of the Directors' fees!

On the Continent, in South America, the Cape, Australia, India, and other quarters of the globe, gas experiences have been varied. In some cases there have been increases in the consumption of gas; in others, there have been considerable reductions—indeed, the tracks of war influences are found in the published results from Continental places near at hand and places remote. The greater of the prejudicial effects are due to coal and freights, and to indifferent markets for residuals. In India and South Africa, the conditions brought about a greater use of local coal; and this was an advantage from the financial point of view. If readers want to obtain a fair indication as to what has happened abroad in connection with the gas industry in this eventful year, they cannot do better than read the reports in our columns of the proceedings at the meetings of the Imperial Continental Gas Association, the European Gas Company, the Continental Union Gas Company, the Danish Gas Company, the Bombay and the Oriental (Calcutta) Companies, the Metropolitan of Melbourne and the Australian (Sydney) Gas Companies, the Cape Town Gas Company and the South African Lighting Association, the Primitiva Gas Company, and the Montevideo Gas Company.

With regard to company promotion work in the gas industry, the United Gas-Works Development Company has run its course, and is in the hands of the Liquidator. There were various attempts to sell small amounts of capital in the ineligible concerns in which the Company were interested, chiefly on account (so it was said) of shareholders who were compelled, owing to various circumstances, to part with the remarkably lucrative securities offered. Some interesting particulars were disclosed during the year as to the operations of the United Company and its founders. Its experiences at floating companies, with very grandiose names and ill-fitting capitals in relation to the size of the concerns, and with reports by "consulting gas engineers" who had never previously been heard of in this connection, ought to be a warning to others not to trespass on the good reputation of the gas industry with schemes with a marked deficiency of good point about them.

Financing the Industry.

In consequence of the heavy demands for money for the financing of the war, the gas industry, in common with other enterprises, came under the interdiction of the Treasury towards the end of January as to the issue of capital without consent. Later on the Local Government Board were linked-up with the Treasury in preventing the raising of additional loans by local authorities, and in urging them to refrain from spending any money upon anything that, for the time being, could be done without. But consent has not been withheld in the gas industry where proof could be given of necessity, in view of local war work, and the work that the industry is doing in connection with the provision of essentials for the war. So intent were the Treasury on ensuring that capital should not be issued under new Acts of Parliament, that during the session all Private Bills had a special clause inserted, prohibiting issues without sanction during the war and for a period after. The ban was also extended to the "exportation" of capital. Of course, the restriction where undertakings had not good floating balances to which they could have recourse, had an effect upon the prosecution of business-getting, through the enforced limiting of expenditure in this direction. But, as a matter of fact, there was no general desire to issue more capital than could be avoided (excepting, for instance, where bank loans existed of heavy amount, and it was good policy to partly liquidate these), seeing that—dividends having been reduced owing to advances in the price of gas, and market prices of stocks having fallen through this, and in common with all other securities—capital could not be issued except at figures, in some cases, considerably below par. There was further discussion of the question in municipal circles of suspending sinking funds; but this was not looked upon with favour by the central authorities. Dealing with this matter, the Secretary for Scotland expressed the view that it would be most regrettable to depart from the principle that the current obligations of each year should be borne by that year.

Then came the new War Loan, with its 4½ per cent. interest, redeemable at par, and with Government security; and this completely altered the standard of financing of all enterprise. Low interest-bearing stocks have not been in good favour for some time past; and they are less so now, with a 4½ per cent. redeemable Government loan and 5 per cent. Treasury bonds in the running. The Government also tried to draw the small investors to put money into the War Loan. Up to a point, they were successful; but the result was not all they had anticipated. In view of this, a campaign of economy was started at a large meeting of Trade Union leaders, who were addressed by the Premier, the Chancellor of the Exchequer, and the President of the Board of Trade. The British workman has been neglected by the Government in the matter of thrift and investment; and those who are not already thrifty want to be educated up to it, and encouraged by interest on their money equal to that which can be secured by the rich capitalist. The experiences of the co-partnership gas companies—of the South Metropolitan Company especially—show distinctly that the cultivation of thrift where it does not already exist among the working classes, and implanting in them the spirit of investment, are not matters of accomplishment in a day. The Government recognizing the need, in view of the changed circumstances, of assisting private enterprise passed a Bill to enable statutory companies to issue redeemable preference and debenture stocks—redeemable on such terms and conditions as may be specified in a resolution passed at a special meeting of the company concerned. There was further discussion in our columns, which was started in the earlier months of the war, as to gas companies obtaining relaxation of the ordinary conditions upon which capital can be issued by them—say, during the war and for a period afterwards, while financial stringency exists. Little was done; but our parliamentary record has shown that the discussion was not without some small effect this year, and promises more next.

In the Stock Market.

There is little to say special to gas stocks and shares. The Stock Exchange which was closed on July 30, 1914, re-opened on Jan. 4 this year under limitations. Then official quotations remained as at the date of closing. But official minimum prices for stocks and shares were fixed immediately afterwards, which minimum prices buyers, with the usual fidelity to personal interests, thought too high, and sellers similarly too low. Since then our stock and share table has shown the prices at which bargains have been effected, together with the prices that ruled at July 30, 1914. Prices of gas securities shrank in common with other stocks; but, at the beginning of the year, the good favour in which gas capital is held was evinced by the comparatively small percentage decline. But when, in the case of some of the sliding-scale companies, a second increase of gas prices had to be made, and this further affected dividends, there was a fairly sharp fall in some stocks. Naturally, throughout the year the varied fortunes of war have had their reflection on even the reduced business transacted. But, of course, everything has had an air of fictitiousness about it. In regard to gas stocks, the price reductions shown by transactions refer to all classes of stock and shares—ordinary, preference, and debenture. Only to the general conditions, and the temporary reductions of dividend owing to the increased price of gas, are attributable the falls in the arket values. Some half-dozen or so examples of what as happened will suffice. In the case of the Gas Light nd Coke Company's ordinary stock, which on July 30 last ear stood at 98-102, business was done early in the year at 7-$89\frac{1}{2}$; but towards the end transactions were at 71-$72\frac{1}{2}$. n the case of the South Metropolitan Company, with the rice of their ordinary stock on July 30 last year at 111-13, business was effected early in the year at $100\frac{1}{4}$-103; ut, towards the end, $78\frac{1}{2}$-$79\frac{1}{2}$ was the price. Tottenham istrict Light, Heat, and Power Company's ordinary stock, n the other hand, stood up well against the prevailing contions. With a price at 115-117 on July 30 last year, business was effected at round about 113 early in the year, and wards the end at $97\frac{1}{2}$-98. Among companies operating road that suffered severely are the Imperial Continental as Association, the Continental Union Gas Company, and e Primitiva Gas Company. On July 30 last year, the ock of the Imperial Continental Gas Association stood at 50-160; early in the year, business was done at 81-84; and ter in the year, at 73-78, but there has been a recovery to bout 83. In the case of the Continental Union Company, 6-79 was the price on July 30 last year; transactions have ecently been at as low as $38\frac{1}{2}$. The Primitiva shares, which ere standing at $5\frac{1}{2}$-6 on July 30 last year, were parting ompany at $3\frac{9}{16}$-$3\frac{11}{16}$ towards the end of the year. In eference to the Imperial Continental, the chief properties eing in Germany is a sufficient explanation of the fall; s to the Continental Union, their chief investment being in e Union des Gaz, the terrific high rates of freight to Italy, e price of coal, difficulties with the Milan Municipality as the price of gas, and no dividend, account for their posion; regarding the Primitiva Company, a break in trade onditions and financial chaos in Argentina preceding the ar, and all the trouble as to coal, freights, and other rcumstances produced by the war, explain the temporary eerless conditions for the shareholders, and the drop in e market values of the shares. The Alliance and Dublin onsumers' Gas Company had the distinction of having an mprovement in the market value of their stock upon the gures at which it stood on July 30, 1914. The Bank rate, hich was fixed on Aug. 8, 1914, at 5 per cent., continued that figure throughout the year.

British Commercial Gas Association.

Close upon the references to the trading and financial atters of the year, allusion must be made to the work of e British Commercial Gas Association. Their activities ave been unceasing; for there was unanimity in the opinion at to discontinue the excellent educational and propaganda ork would depreciate the value of that which had been one anterior to the war. The Executive and General Comittees were right in both their judgment and resolve; and ey were well backed-up by the subscribers—company and unicipal gas undertakings and the Society of British Gas ndustries. Moreover, war conditions notwithstanding, new bscribers came in—partly through the district recruiting ampaign, partly through the conviction of the administrators f further undertakings as to the valuable work that is being one by the Association, and partly through the solid character of the example provided by the existing subscribers. he firmness of the allegiance of the old subscribers speaks loquently as to their belief and experiences; and they know hat is not known outside, something as to the many and aried channels in which the Association work—channels hich are beyond the reach of the units of the industry, and an only be operated in by a co-operative and representative ody. At the annual meeting of the Association, Bailie axton, of Glasgow, pointed to the indispensability of the ork, and urged those undertakings still standing aloof to tudy the list of cities and towns the gas administrators of hich are all satisfied that the work is essential to an inustry whose future expansion will be the measure of the dvantage taken of every means of producing it. At the ime he was speaking, a sum of nearly £100,000 had been xpended on the work of the Association. During the year, he Association have had new and fertile ground on which o work in connection with the use of gas in munition factories, in hospitals, military camps, nursing homes, and so orth. The view of the Association is that, though the use f gas in some of these directions may be temporary during he war, experience and satisfaction will have a lasting eneficial influence. Any business taken in hand in this onnection should be so done that it is in itself an influential advertisement. However, the Association have entered upon a new year of work well backed by the subscribers, and with Sir Hallewell Rogers, the Chairman of the Birmingham Corporation Gas Committee, as the President.

War Damage to Gas-Works and Other Property.

Speaking generally, there has not been any large amount of destruction of gas-works property owing to the war. Concerning the bombardment of East Coast towns on Dec. 16, 1914, by certain German cruisers—which paid a cowardly nocturnal visit to unfortified towns, and made a hurried flight back when they descried certain units of the British Navy on their track—particulars as to the amount of damage caused at the Hartlepool Gas-Works were available early in the year. All the gasholders were struck and pierced by shells, causing the loss of the whole of the gas in stock, and temporarily depriving the district of its supply, Eight of the Company's employees were injured, and one subsequently died. The loss and damage were estimated at £7500. The Engineer (Mr. A. W. Branson) referring to the matter at the meeting of the Wales and Monmouthshire Institution of Gas Engineers and Managers in May, gave some interesting and instructive details of his experiences [see "Journal" for May 25, p. 451]. At the gas-works at Scarborough, which town was also the object of the attentions of the sea raiders, the result of the bombardment was that not 20s. worth of gas was lost. No damage to gas-works has been occasioned by air raids, though distributing mains, in two or three cases, have been fractured where bombs have dropped in roadways. At the meetings of the Imperial Continental Gas Association, information has been given, as far as available, as to damage to their works in the fighting areas. Other particulars as to French works will be found in the "Journal" for Sept. 14 (p. 570). The Rheims Gas-Works suffered very severely from bombardment [see "Journal" for May 25, p. 458]. One experience there bore out the various theories put forward at the commencement of hostilities as to what would happen when projectiles fell upon gasholders—namely, that when a holder runs freely upon its guide-framing, and can descend in such a way that the gas is always under pressure at the perforation, emptying is effected without inconvenience, until the holder has grounded. But the pressure in the holders could not be maintained at Hartlepool owing to the breaking of the mains running from the retort-houses. Through mines and torpedoes, several colliers conveying coal to gas-works have been sunk; and many thousands of tons of good gas coal are consequently lying at the bottom of the sea.

On the Works.

The matters already dealt with are largely of unusual interest and significance in view of the war; and thus the excuse for having devoted so much attention to them. The more ordinary affairs of the industry have been kept by the war rather severely in the background; and we will only remind of a few of the salient features. Take works and plant first, the capital restrictions, war work, as well as the extraordinary anxieties of the year, have largely put into abeyance works' extensions. But there have been in our columns a few descriptions of new works and extensions. Vertical retort installations have been prominent. This plant has also been making great headway in America. In other parts of the world, too, it continues to obtain increased adoption. At Cape Town, it has been found that verticals are especially suitable for carbonizing inferior local coals. Horizontal retort working, owing to further improvements in machinery for dealing with heavy charges, has also gained in position during the year. The De Brouwer, the Fiddes-Aldridge, and the Bancroft-Hansford retort charger (in conjunction with the Guest and Gibbons machine) have received reference in this connection. Some special articles by Mr. H. C. Widlake have been devoted to the maintenance and care of the first-named machine. Further use in Continental works of chamber ovens for gas manufacturing purposes have been described. Occasional references have appeared to low temperature carbonization. The late Professor Lewes dealt with the subject in an address to the London and Southern Junior Association; and Dr. F. M. Perkin, in a lecture, referred to the extravagant anticipations that had been put forward in this connection. We are at present waiting for more information as to the

Coalite installation at the Old Silkstone Collieries, Barnsley. Telpher plant has increased its field of operation; and Mr. R. E. Gibson has shown the economy of the crane and gantry for moving materials. Following the Windsor Street (Birmingham) installation, the Tottenham Light, Heat, and Power Company have adopted turbo-driven gas-exhausters. Speaking of this Company reminds of the description given of their gas-driven electricity station for the supply of Wood Green. A German invention has been described for the construction of gasholders without water-tanks. Nothing new has transpired in association with water-gas manufacture; but methods of operation have occasionally been discussed in papers—especially from America. Early in January, there was published the full text of the paper by Mr. E. V. Evans, before the Society of Chemical Industry, on the removal by heat of carbon bisulphide from coal gas, as practised at the works of the South Metropolitan Gas Company. Several instances of the application of reinforced concrete in gas-works have been described. An interesting engineering contribution was that recounting the flooding and the work of restoration of the Astoria Tunnel, New York. A series of articles was published by us early in the year on the use of electricity plant on gas-works; and hints were given as to the realization from them of the most effective working.

In regard to methods, the recognition grows of the need for attaining on economic grounds the maximum efficiency on gas-works. Allusion has been made to this earlier in the retrospect in connection with residual products. There has also been insistence on the need for constant control in processes in which heat is concerned. At a German gas-works, experiments showed the economy to be derived from making use of the heat that goes to waste on gas-works. With regard to retort material, the Refractory Materials Committee presented a very short report this year at the Institution meeting; and it was seen that slight modifications have been made by the Committee in certain of their conclusions. The deterioration of retort material by salty coals has received further consideration. The importance of the thermal conductivity of refractory materials has been accentuated by an investigation by Professor J. W. Cobb and Messrs. Dougill and Hodsman. Discussed, too, by Professor Cobb and Mr. Harold Hollings has been the subject of heat exchanges in carbonization, which seems to be a matter that may have a very direct bearing on the determination of the best practical carbonizing conditions for different gas coals.

Bye-Product Coke-Ovens.

A great deal has been written during the year on the coke-oven industry. Several papers referring thereto have appeared in our columns, as well as a number of notes by "Event and Comment." There are four outstanding features this year relating to the coking industry. The first is the successful formation of the Coke-Oven Managers' Association, at the inaugural meeting of which the first President, Mr. George Chrisp, delivered an interesting address on the progress of the bye-product industry. The second is that Leeds is now purchasing about 1 million cubic feet per day of coke-oven gas for general supply, following the example of Middlesbrough. The third is that the Yorkshire Power Company are now utilizing coke-oven gas for boiler firing at one of their stations for generating electricity. The fourth is that there has been a considerable amount of criticism of the want of scientific control in connection with bye-product coke plants, and the beehive oven has received further condemnation for its extreme wastefulness.

Distribution and Meters.

There has been little to particularly attract notice in connection with distribution. Sundry papers and articles have appeared on the subject; and incidentally there has been some further good testimony regarding the value of the lead wool joint. A useful compilation as to the cost of the re-instatement of pipe trenches in the area of the Metropolitan Water Board was published in our issue for June 29 (p. 768); and we have had Mr. Reginald Brown putting forward a plea for a better understanding between road authorities and those who have to open roads in connection with their distribution systems.

As to meters, an Association of Official Inspectors of Gas-Meters has been formed, with the object of procuring, as far as possible, uniformity of practice in the administration of the Sales of Gas Act. With regard to high-pressure meters, it was suggested, in the annual report of the Manchester City Justices Committee, that, should the high-pressure meter powers obtained by the London County Council and the City Corporation prove satisfactory, the Board of Trade should take steps to apply them generally. A description of the "B.T.H." steam-flow meters appeared during the year. In connection with prepayment meters, more frequent collections have been urged, in view of the shortage of copper.

Lighting, Heating, and Power.

Generally speaking, there is not much to be said under this heading. The war has had effect upon topics and improvements that would in ordinary course call for notice. But the year showed that, in every way, we are satisfactorily tending towards greater scientific accuracy in both production and application. The Joint Committee on Ventilation of the Institution of Gas Engineers and the Leeds University (of which Committee Professor Arthur Smithells is the Chairman) have been going about their work in a methodical manner; and an instructive report was presented by the Research Chemist (Mr. William Harrison, M.Sc.) at the meeting of the Institution. In other ways, a great deal of attention has been paid to this subject in association with the application of gas; and architects, there are indications, are becoming better informed as to the applications of gas, and how particularly gas heating can help them in structural design, by the use of small flues for gas-fires, and by promoting convenience in the kitchen by, when erecting new houses, the immediate introduction of a gas-cooker, gas-heated circulating water-boiler, and a gas-fire. Mr. W. L. Westbrook showed, in a recent paper read before the London and Southern District Junior Gas Association, that practical experience proves there is economy in this, as wel as convenience, for householders. Among other genera topics, a translation of a lecture on the hygiene of gas, by Dr. M. von Gruber, has been published by us; and the doctor has been subject to some well-deserved criticism by Mr. W. J. A. Butterfield.

An event of the year has been the issue of the Departmental Committee's report on the lighting of factories and workshops. By it the importance of good illumination was shown in respect of the improving of works' output, the prevention of accidents, and the protection of the eyesight of workers. Some recommendations as to minimum foot-candle illuminations were made by the Committee. At a meeting of the Illuminating Engineering Society, it was urged that the Departmental Committee should go further in the matter of the relation of illumination to eyesight. The more there is discussion, the greater are seen to be the difficulties of prescribing, except in a very general way, standard illumination for all sorts and conditions of factories and occupations. In connection with high-pressure lighting, Mr. A. E Broadberry gave, at the spring meeting of the Eastern Counties Association, a description of excellent examples of factory lighting by means of high-pressure gas. Some illustrations of the splendid effects obtained with this system have also come from the Panama-Pacific Exposition, the Dunfermline station of the North British Railway, and from the suburbs of Melbourne.

As to mantles, we are now assured, largely through the agitation initiated in our columns, of a supply of thorium nitrate, without having to rely upon Germany; trading in the Travancore sands having lately been put under proper control. On the question of mantle trading, there has been evidence—the matter was discussed on a paper by Mr. R. J Milbourne, at the last meeting of the Society of British Gas Industries—that German mantles have found their way to the British markets through neutral countries, and under various disguises; and letters in our "Correspondence" columns indicate that the traffic has been very considerable The steps taken by the Government to exercise better control over imported goods may have the effect of countering Teutonic artifices in this direction.

There has been little new in the gas-cooker line. Miss Edden is responsible for the design of a new externally heated oven for domestic purposes. The economy and output of large biscuit factories have been raised by the production of the Baker-Keith-Blackman gas-heated oven, the virtues of which have been described in our columns.

In connection with gas-fires, as well as other gas-consum- g appliances, there is continued general movement to- ards still higher efficiencies. May this proceed; for upon onomy and efficiency the trading progress of the industry pends. In the matter of gas-fires, it is clear from a cture delivered by Mr. Harold Hartley, M.Sc., that ther- al, hygienic, and ventilating efficiencies require study and eatment in combination and not separately. For the sting of the radiant efficiency of fires, the R. S. Smith ater-flow radiometer and the Ruebens thermopile have en the subjects of further condemnation. Early in the ar came the new Richmond radiometer; and later the lometric method for the measurement of radiant heat, for hich Dr. W. A. Bone, F.R.S., Professor W. L. Callendar, .R.S., and Mr. H. James Yates are jointly responsible. he movement, initiated by Messrs. John Wright and Co. ith their "Injector-Ventilating" arrangement, for increas- g the ventilating capacity of gas-fires has continued; and w designs, directed to securing ventilation supplementary the flue, were brought out at the commencement of the esent heating season by the Richmond Gas Stove and eter Company and the Davis Gas-Stove Company. Silent rners for gas-fires have received further improvement; d it is seen that in the modern types of fires, the position hich Mr. Yates took up some time since, as to the high nopy, has been fully vindicated by practice. This was matter incidentally raised in connection with the contro- rsy that arose in 1912 over his statement: "A fire that rries off all its products without being attached to a flue ill, when an ordinary chimney draught comes into play, evitably carry off more than the products—to wit, an un- cessary number of heat units as well, and a lowered room- ating efficiency is the result." Among the new fires intro- ced were a semi-circular fronted one, and a circular fire, e appearance of which led to discussion regarding the tter distribution of radiant heat.

There has been a great boom in the use of gas-furnaces industrial works, more especially for the rapid and uni- rm production of munitions of war. In consequence, l the firms who specialize in gas-furnace work have been rticularly busy. Mr. H. M. Thornton read a paper on e use of gas-furnaces in war time and always, at the oyal Society of Arts; the Brayshaw furnaces were put on hibition in Sheffield; and altogether there has been a great al of life in this direction, which will have permanent ad- antage. The furnaces that have been installed this year present an immense aggregate consumption of gas. A uple of highly informative papers on the treatment of on and steel by gas heating have been published by Pro- ssor A. H. White and Mr. Homer T. Hood. They will e found in the "JOURNAL" for Oct. 19 and Nov. 9.

As to the use of gas for power purposes, there are dis- nct signs of a retracing of steps by manufacturers from ction-gas to the less troublesome and more convenient town as, where prices are suitable; and, with the greater atten- on now given to the regulation of engines, and the adoption more modern ones, efficiency and economy are proving bstacles to the electric motor. Mr. Widlake mentioned an teresting case where an old 6 B.H.P. gas-engine displaced electric motor of equal horse power in a laundry—the gine working efficiently two hydro-extractors, where the ectric motor could only inefficiently work one.

TECHNICAL AND OTHER BODIES.

The war has had a tremendous influence on the work of chnical organizations; and the character of their proceed- gs has been considerably altered. The Council of the nstitution of Gas Engineers abandoned the proposed meet- g at Southport, and instead had a short morning sitting in ondon, without papers. But there was a brief address by he President (Mr. John Bond), who the Council invited to ontinue in the presidency another year; but work at South- ort and for the Ministry of Munitions prevented him ac- eding to their wishes. Before retiring from the chair, Ir. Bond subscribed 100 guineas to the Institution Building und. Mr. John Young has succeeded Mr. Bond in the residency. Although the annual meeting was short, it was n interesting one—made so by the President's address, he reports presented, and the discussions. As will already ave been seen, the President and Council have been very usy during the year in dealing with the different adverse nfluences (arising from the war) upon the affairs of the in- lustry. Coal supplies, tar prices, railway traffic, sea transport, recruiting, medals for workers, and industrial finance were subjects that frequently claimed their attention and action. Some of the District Associations held full meetings; others did not. The junior organizations met and also engaged in visits, with the exception (this winter) of the Manchester organization; but in some cases the programmes for the present session have been shortened. No signs of diminishing vitality are shown by the junior organizations. Reference has already been made to the work of the British Commercial Gas Association. The Society of British Gas Industries have held meetings, under the chairmanship of Mr. Alderman F. Templer Depree. In his address at the March meeting, he proved that the existence of the Society had been fully justified. The San Francisco Gas Congress, in association with the Panama-Pacific Exposition, was a great success. The President of the Congress was Dr. A. C. Humphreys; and the President of the American Gas Institute (also in session on the same occasion) was Mr. E. C. Jones. Their respective addresses evinced an unshaken belief in the future of the gas industry. The German and Austro-Hungarian Associations both held brief meetings this year. The Société du Gaz abandoned their meeting, as did also the Italian Gas and Water Association; but the Dutch and Norwegian Associations held theirs.

The Illuminating Engineering Society have also met, and contributed some interesting matters to questions of special interest in connection with illumination. But, of course, in this case as in others, the character of the work has suffered somewhat through the war monopolizing so many men, and all people's minds. In this connection, it may be mentioned that the street-lighting specification has not yet assumed definite shape; but certain modifications have been introduced, providing for the inclusion of maximum as well as minimum horizontal plane illumination (the one being within definite limits of ratio to the other), and for some specified control as to the height of all lamp columns. The work of the International Illumination Commission has been interrupted; but the various National Committees have been proceeding on independent lines. Our own Committee have elected Mr. W. Duddell, F.R.S., as Chairman in place of the late Mr. Edward Allen, and Mr. John Bond has been appointed a Vice-Chairman. Mr. Jacques Abady has been elected a member of the Committee. A translation, by Mr. W. J. A. Butterfield, of a study by Dr. E. Ott, on the dependence of the light of the Hefner lamp upon atmospheric conditions, more especially atmospheric pressure, has had extensive publication. There are indications of a closer alliance of the Chemical Societies with the industrial organizations; and the presidency of the Society of Chemical Industry by Mr. Charles Carpenter, D.Sc., should have influence in this direction.

The Gas Companies' Protection Association continued their excellent work, particularly assisting in the actions which helped the electricity supply industry to appreciate its legal position in the matter of powers of charge. Mr. H. E. Jones, the Chairman of the Council of the Association, has again urged the larger co-operation of the smaller gas undertakings; and a feature of his address at the annual meeting was his censure of the coalowners in the matter of interpreting of the Coal Prices Limitation Act.

PROFESSIONAL TOPICS.

One unpleasant feature of the year has been the attitude of the members of certain municipal bodies towards the gas profession; and it has been the duty of the "JOURNAL" to speak somewhat plainly in defence of the profession, and its rights and status. What happened at Huddersfield, Blackburn, Neath, and Stoke-on-Trent will be well within the memory of readers; but the occurrences have not appreciated, but have had a distinctly bad effect upon, municipal service in the eyes of the members of the profession. In regard to Stoke-on-Trent, the Gas Committee there have carried the day against those who stupidly sought to reduce the office of gas engineer and manager to a level that would have excluded from application for the position men of talent and ability. In this connection, Mr. James Macleod raised the question, in an article in our columns, as to what the Institution of Gas Engineers had done to protect the members of the profession in municipal service against the opprobrium and degradation to which a section of local councillors subject them in a few places. The answer was that the Institution has done nothing; and Mr. Macleod's article received widespread approbation. Criticism has also had to be made about the revival of the circular-inquiry nuisance, especially in connection with circulars emanating from Stoke-on-Trent and Slough regarding professional salaries. Other circulars that came in for condemnation —issued from Huddersfield and Margate—referred to public lighting questions. We think this trouble is again quashed—at any rate, for the time being.

Education and Examination.

There is not much to be said this year on educational matters in connection with the industry, owing to (as Professor John W. Cobb said in his annual report as Livesey Professor at the Leeds University) the loyalty of the students taking them to the front or to munitions work. But the department over which Professor Cobb so ably presides has not ceased work—investigations, with the limited assistance available, proceeding the same as far as is possible. After the war, there will be a larger requirement for trained investigators in connection with the industries; and so, at all the Universities and technical colleges and schools, there is bound to be a great revival of activity. An illustrated description that has appeared in our columns shows how thoroughly Professor W. A. Bone has organized the Fuel Laboratories of the Chemical and Technological Department of the Imperial College of Science and Technology. The Institution of Gas Engineers have established at the Leeds University, a scholarship, bearing the name of Sir Corbet Woodall, of the annual value of £50—this having been made possible through Sir Corbet's personal generosity.

The number of candidates presenting themselves this year for examination in "Gas Engineering" and "Gas Supply" was naturally greatly reduced; and the respective Examiners—Mr. Samuel Glover and Mr. Walter Hole—have had to comment on the deficiencies of the candidates. This indicates a need for a more definite scheme of training being drawn up for gas-engineering students—a matter that was raised by Mr. F. J. Bywater some time ago, and since revived by Mr. David Fulton. Mr. James Macleod in our columns last week called attention to the scheme drawn up by the Manchester School of Technology. Mr. Thomas Glover has stated his opinion that the intrinsic value of the City and Guilds examinations and the certificates would be greatly enhanced if all candidates were compelled to pass a preliminary examination in chemistry and mechanical engineering. The first gas-fitters' examination has shown the Examiners (Mr. Henry Kendrick and Mr. Ralph Halkett) the weaknesses in the training of the candidates; and their comments on the subiect will no doubt have good effect in the direction of improvement.

Gas Legislation.

The session of Parliament this year saw one of the smallest crops of Gas Bills and Provisional Orders on record; but next session will beat its predecessor in respect to numerical leanness, though the quality promises to be somewhat better. The points of the session's work to be noticed are not numerous. In connection with the model residuals clause, it was noted with pleasure that some Committees justly allowed Bills to go through without the one-third restriction. With few exceptions, promoters now ask for the calorific standard and test as a matter of course. But the session saw promoters suggesting a level standard of 500 B.Th.U. (total heat value), instead of 540 B.Th.U., with 7½ per cent. margin. The Board of Trade saw no objection to the severance from the standard of the marginal limb; and Select Committees, as also the Unopposed Bills Committee, were guided by the Board. Capital questions also had prominence. Though the inhibition of the Treasury as to capital-raising has, from the first, been present in the mind of the administration of every gas undertaking in the country, the Treasury seemed afraid lest the possessors of Acts passed during the session should take it that the new capital powers granted by Parliament subsequent to the Treasury notification opened to them the door to fresh issues without sanction. They therefore had a clause inserted in Bills specially prohibiting promoters, for a period, from issuing any part of the capital without their permission.

The capital position of gas undertakings in war time was brought before Committees. Hard times have come, and they will be sterner yet, in respect of capital-raising. With the reduced dividends that are being paid by some sliding-scale companies, stock has had to be sold much under par. The new 4½ per cent. war loan has also set a new standard upon the earning power of money. It is therefore only right that those in charge of gas undertakings should see what, if anything, can be done to get relief from statutory conditions which, under the present exceptional circumstances, are obstructive to the securing of any capital on the best possible basis. The Ascot District Gas and Electricity Company sought relief from the auction clauses for the space of years directly affected by the war. This was refused; but the same Committee gave the Company permission to make greater use of their credit by raising the borrowing powers to one-half proportion, in place of the customary one-third. In the Northwich Gas Bill, the Company (it is a maximum price Company) obtained capital conversion powers on a 6 per cent. basis, as their advisers felt that a 5 per cent. basis would not be much good. A useful Act will be the Statutory Companies (Redeemable Stock) Act; and this should not be overlooked. Then the Local Government Board were anxious to get more uniformity in the loan-repayment periods granted in municipal Bills, with a reduction of the periods. They tried this session to persuade Committees to leave the decision of the periods in their hands. Committees, however, did not see fit to relinquish their duties in this respect; and divergent results obtained, instances of which were given in an editorial article in the "Journal" for Aug. 17.

The Chelmsford, Lurgan, and Skegness Purchase Bills passed. The Northwich Company resigned their new works' proposals in view of the opposition shown, and consented to remain a maximum price Company. A purchase clause, after the lines of the Chelmsford one of the preceding session, was agreed to between the Company and the local authority. The large schemes of electricity concentration for London were withdrawn, as the Government were not disposed to have time absorbed by contentious matters of such magnitude while the war continued. The Yorkshire Power Company, who wanted roving lighting powers, were sent home to attend to business on the lines of the powers already possessed, and were informed that Parliament were not prepared to grant them preferential rights. The Spennymoor and Tudhoe Gas Company were given the right to hire-out dynamos in conjunction with gas-engines. The Plymouth Corporation had their gas-fittings and hiring powers confirmed in respect of Devonport; and electrical powers on the same lines, existing as they did in Devonport, were granted by a Lords Committee in relation to the whole of Plymouth. But threatened further opposition by the local contractors in the lower House led to an agreement for the application of the model clause, with its limitation of liberty in connection with wiring and dealing in electrical fittings. The Northumberland clause was obtained in respect of an extension of the electric supply area at Southampton, though, in the special circumstances, it was refused by the Board of Trade and by the first House before which the Order came for confirmation.

An event of personal importance is that Mr. Balfour Browne, K.C., who has taken part in all the prominent gas fights for many years past, has intimated his intention of retiring from practice in the Parliamentary Committee rooms. This intimation has caused sincere regret among his "learned friends" and those whose professional duties take them to the Committee rooms.

In connection with Parliamentary work, a very useful book to those promoting Bills in Parliament was published during the year—Abady's "Compilation of Gas, Electricity, and Water Legislation."

Calorific Value.

The new conditions in relation to the calorific standard for gas, as framed in the Act of the Gas Light and Coke Company in 1914, necessitated a revision of the "Notification" of the Metropolitan Gas Referees, which was published early in the year. The conditions of testing prescribed by the Referees are applied generally. Canada has taken the lead in prescribing a universal calorific standard for gas in lieu of the illuminating power one. The standard adopted is 520 B.Th.U. (total heat), without a margin. The Bureau of Standards at Washington have recommended that general gas supplies should be of 600 B.Th.U. gross, although, in cases where unenriched coal gas or bye-product oven gas is sold, they consider that 570 or even 550 B.Th.U. might be a reasonable standard. The Maryland Public Service ommissioners have also prescribed 600 B.Th.U.; while in unsas no natural gas is to be sent out of a heating power less than 800 B.Th.U. The Imperial Gas Association Japan have recommended a calorific value standard of 520 Th.U. gross, with a margin down to 470 B.Th.U.—proling that the average is 520 B.Th.U. on three consecutive ys. As mentioned in the preceding paragraph, no gas ppliers at home think of going to Parliament now with sting clauses that do not provide for a calorific value andard in place of the illuminating power one.

LEGAL MATTERS.

Happily there has been comparatively little litigation in nnection with the gas industry this year; and cases are w in which any important principle has been involved. ostly the matters have been ones of general dispute, in nich the Courts were asked to adjudicate on facts. The ost important action from the general point of view was e Ilford one, in which the District Council were brought book by the Gas Company for making terms of charge r electricity which were *ultra vires*. The Long Eaton se caused the Ilford Council to reconsider their position; and they "knuckled under," and were condemned on the points raised, including trading in fittings, &c., for nich they had no power whatever. A good digest of the ints at issue, and of the result, in the Long Eaton case, was pplied by Mr. George Stevenson in a paper read before e Midland Association [see "JOURNAL" for March 16]; nile Mr. W. B. Farquhar, in his Presidential Address to the astern Counties Gas Managers' Association, gave a full atement of the Ilford case and proceedings.

There was an action against the Conway Corporation for oney alleged to have been lost, by a firm of contractors for nks and constructional ironwork, through their men emoyed on a contract at the gas-works being idle for several urs daily in consequence of fumes said to come from the tort-house. The Corporation won the case; the Court lding that there was no claim in law. A case touching oon German contracts and the war had reference to the arwen "Munich" chamber installation. In this Messrs. seph Morton, Limited, claimed against Messrs. R. & J. empster, Limited, in respect of goods sold and delivered. the event, the Court held that the defendants in acceptg goods from the plaintiffs were under a contractual oblition to pay for them; and more especially so as the rmer had banked the sum of money received from the orporation which included the price of the goods for which ey were sued, and which would otherwise have been held l asked to account for it to the German Company at the ose of the war. In connection with a gas-stokers' strike Coatbridge, the Coatbridge Picture House, Limited, made claim for loss and damage sustained by them in conseuence of the failure to supply them with gas. The claim as, however, dismissed. A case in which a claim was ade against the South Suburban Gas Company had referice to the recovery of damages for injury caused to a nild through the overturning of a fire brazier which was eing used while repairing a gas-main. In the County ourt plaintiff was awarded £25. The Company appealed, nd lost; Justices Avory and Lush holding that the conusion might quite reasonably be come to that what the efendants were doing constituted, in the circumstances, nuisance in the sense that they were doing something on, adjacent to, a highway which was dangerous to persons wfully using it, unless proper steps were taken to guard gainst accidents. The Swansea Gaslight Company suceeded on appeal in causing the Swansea Rural District ouncil to comply with an agreement for lighting part of eir territory, out of which agreement they were trying shuffle. A question relating to a coal contract in which e Cardiff Gas Company were concerned came before Mr. ustice Lush. The plaintiff made a claim against the Company for the value of some coal delivered; and the Company ounterclaimed for £1100—the difference between the conact and the market prices for coal which had to be purhased elsewhere, owing to non-delivery by the plaintiff. he plaintiff's case was that non-delivery was due to an ccident causing the partial stoppage of the colliery. His ordship was of opinion that it would be too narrow a contruction to put on the contract that, unless the whole of the vorks at the colliery stopped, the plaintiff was not entitled o relief.

A particularly painful case was that in which Thomas H. Lamb, the late Secretary of the Walton-on-Thames Gas Company, and George W. Ross, chief clerk, were charged with feloniously stealing certain sums of money. Lamb was eventually found "Not guilty;" while Ross (who pleaded "Guilty") is now passing through a sentence of twelve months' imprisonment, with hard labour. A collector of the Salisbury Gas Company was sentenced to six months' imprisonment for embezzlement. A settlement was made of the affairs of the Ticehurst Water and Gas Company—one of the ill-fated group of promotions by a certain City clique which claimed considerable attention some time since. Under the lighting restrictions order, the Thetford, Herne Bay, and Arlesley (Beds) Gas Companies have had to pay small fines for having too much light at their works.

LABOUR.

A curious and painful state of things has existed this year in large sections of the labour world. While men of all stations in life and of all occupations have gone out even willing, if need be, to make the supreme sacrifice in the defence of the honour and safety of our country, there has been a very considerable amount of unrest among labour at home—at the bottom of it all being selfishness. For this the opportunity provided by the war has been looked upon as a grand thing. Duty and patriotism have taken second place; comrades in the trenches have, action shows, been largely forgotten, and little cared for, by the malcontents at home. Thank goodness this has not been general, as witness the work in the munitions factories. Had it been general, the country would have been thrown into desperate straits, and its part in the war would have had quick and most deplorable ending for us and our successors. But the war efficiency of the country has been depreciated by the labour troubles. Reference has previously been made to the immense difficulties in the coalfields, especially in South Wales. Even ships containing food and munitions for the front were at one time held up through a strike of dockers. War bonuses have been granted in almost every industry, in view of the higher cost of living; and now a movement is afoot among the trade unions to make these payments permanent. This is one of the items in the programme of the great labour combine just brought about by the Miners' Federation, the National Union of Railwaymen, and the National Transport Workers' Union. There have been hints, too, of a further trade union movement to secure still higher standards of wages; and at the recent meeting of union leaders, at which Mr. Asquith, Mr. M'Kenna, and Mr. Runciman spoke on the subject of economy, appeal was made not to cause further embarrassment by encouraging any higher wages movement. In the gas industry, there were differences with workers, principally as to their wages, at Birkenhead, Carlisle, Cheltenham, Clonmel, Coatbridge, Limerick, Macclesfield, and Maryport, and threats of trouble were heard elsewhere. Co-partnership has shown its greatest power and advantage in these times when, owing to increases in the price of gas, most profit bonuses have been reduced. Other matters referring to labour in the gas industry are mentioned under the cross heading "Gas Trading and Other Conditions."

PERSONAL MATTERS.

The list of official changes that have been made during the year is of remarkable length; and we can only notice some of the representative ones. Out of alphabetical order we should first mention the retirement, on account of ill-health, of Mr. W. Doig Gibb from the Chief Engineership of the South Metropolitan Gas Company, and the appointment of Mr. G. M. Gill (Assistant Engineer of the Commercial Gas Company) to succeed him. Mr. R. E. Gibson has succeeded to the Engineership of the Liverpool Gas Company on the death of Mr. Edward Allen; while Mr. Ernest Astbury has been appointed Assistant Engineer to the Company, and Mr. Edward Allen (son of the late Chief Engineer) has been placed in charge of the Linacre Gas-Works. Mr. Joseph Cash has retired from the Chief Engineership of the Brighton and Hove Gas Company, and is succeeded by Mr. Charles H. Rutter, with Mr. F. Smallbone as Assistant Engineer. Mr. W. J. R. Baker has resigned the Mansfield management. Mr. T. F. Canning has gone to Weymouth. Mr. Samuel Carpenter has taken up duties as Engineer and Manager at Cromer. Mr. F. Chadderton has been appointed Manager of the Barrow-in-Furness gas and water undertaking. Mr. W. D. Child has retired from Romford, and has been appointed a member of the Board; Mr. J. C. Wright being his successor as Engineer and Manager. Dr. W. B. Davidson has left Birmingham to take up duties as Chemical Engineer to British Dyes Limited. Mr. S. W. Durkin has been appointed Engineer of the South Australian Gas Company. Mr. J. Fazakerley has resigned his position at Goole. Mr. S. E. Figgis has relinquished the Engineership of the Ballarat (Victoria) Gas Company. Mr. William Ford has retired from Stockton-on-Tees, and Mr. Matt Dunn has succeeded him, with Mr. Ford as Consulting Engineer. Mr. David Fulton has taken up the work of his late chief (Mr. W. Blair) at Helensburgh. Mr. A. Morton Fyffe has removed from Nelson to Blackburn, and has been succeeded at Nelson by Mr. Dugald Currie. Mr. F. Higginson has retired from the Managership of the Broadstairs Gas Company; and Mr. W. Dallas has been appointed Secretary and Manager. Mr. Norton H. Humphrys has resigned from Salisbury, and has been succeeded by Mr. William Fielden. Mr. W. C. Jackson has gone from Merthyr Tydfil to Neath, in succession to Mr. R. A. Browning. Mr. Leonard J. Langford succeeded his father as the Engineer and Manager of the Stoke-on-Trent Gas-Works. Mr. J. W. M‘Lusky has taken charge of the Airdrie Gas-Works. Mr. J. M‘Nicholl has taken up the duties of Engineer and Manager of the Mossley Corporation Gas-Works. Mr. W. H. Mainwaring has succeeded his late chief (Mr. John Carter) at Lincoln. Mr. H. C. Page has been appointed Engineer of the Canterbury Gas and Water Company. Mr. Samuel Shadbolt has taken up the combined duties of Engineer, Manager, and Secretary of the South Bank and Normanby Gas Company; while Mr. Walter Shadbolt has succeeded his brother at Fleetwood. Mr. C. S. Shapley is now the Engineer and Manager of the Southend Gas Company. Mr. F. Shewring has transferred his services to the Tawe Valley Gas Company. Mr. H. Singleton (formerly draughtsman and chemist) has been appointed Engineer and Manager of the Huddersfield Corporation Gas-Works, in succession to Mr. Edward Harman. Mr. James Taylor has gone from Mossley to Weston-super-Mare. Mr. Reginald Thomas has been appointed Manager at Droitwich. Mr. E. B. Tomlinson has taken up the duties of Engineer of the Nechells Works of the Birmingham Corporation. Mr. J. G. Tooms has been appointed by the Christiania Corporation engineer for the construction of their new gas-works. Mr. E. J. Wellens obtained the Superintendentship of the Grimesthorpe Works of the Sheffield Gas Company. Mr. T. Wilton has retired from the position of Superintendent of the Products Department of the Gas Light and Coke Company. Mr. H. R. Wimhurst is the new Engineer and Manager at Bury St. Edmunds. Mr. E. D. Wooton has gone to Abertillery.

There have been jubilees during the year. Sir Corbet and Lady Woodall have celebrated the jubilee of their marriage; Mr. G. R. Hislop of his fifty years' service as Engineer of the Paisley Gas-Works; and Mr. J. H. Penney of the same length of service at South Shields.

To the Great Beyond.

During the year, heavy tribute has been laid by Death upon the gas industry. We will not mention all the names of friends with whom it was a great grief to part, and by the loss of whom the industry is the poorer. The roll of departed ones includes the names of Mr. Edward Allen, Mr. William Blair, Mr. Thomas Bower, Mr. John Carter, M. de Brouwer, Mr. Joseph Hepworth, Mr. William Langford, Professor Vivian B. Lewes, Mr. Adam Macpherson, Mr. E. H. Millard, Mr. Joseph Morris, Mr. Henry O'Connor, and Mr. William Swinburne. The war has also removed several who have been gallantly fighting for King and country; among them being Captain Richard B. G. Glover and Mr. Bryan Crossley. From among those engaged in the manufacture of plant and appliances for the gas industry, there have been removed Mr. Thomas S. Clapham, Mr. William Clapham, and Mr. R. Clayton (Cannon Iron Foundries); while Mr. G. J. Eveson is another well-known name in the industry's trading world. Men who have held distinguished place in gas administration, but are now no more, are Colonel H. Oakden Fisher, Dr. G. A. Jeffery, Sir E. Chandos Leigh, and Mr. Edward Wright. Mr. R. Forbes Carpenter, the highly respected former Chief Inspector under the Alkali Works Regulation Acts, also passed away during the year.

Accidents, Etc.

Of fatal accidents on gas-works there have fortunately been but few, having regard to the dimensions of the industry and the ramifications of its operations. Not more than a score of deaths have been recorded in our columns as the result of accident; but the most notable one, and the most inexplicable, was the explosion at the Beckton Gas-Works, during the removal of a quantity of benzol. The assistant still man was killed. There have been a few explosions, suffocations, and suicides; but the number has been less than has been recorded for some years past.

In Conclusion.

Now we have come to the end of our annual task. The retrospect is not altogether a cheerful one; but there are silver linings to the clouds. The manner in which the industry is passing through the cataclysm of unprecedented circumstance is proof of its great vitality and capacity for endurance. It is, too, a matter for congratulation that the industry has been found so useful, and indeed so indispensable, in the war. But enough of the past. We stand at the close of this year of terrible experiences with unabated confidence as to the ultimate victory of our country and her Allies; and when victory has been secured, and peace restored, we hope to see the gas industry, and have assurance that it will, gradually move to more normal conditions, and then continue its progress to greater service and usefulness. The circumstances of the future may not all be exactly as of the past; but in the industry's affairs a flexibility has ever been shown which has enabled it to bend to new conditions, and yet make greater advance. As in the past, so in the future. May the New Year see a restoration of Peace through the decisive defeat of our enemies, and the world be again placed in a state of composure. That is the prayer of all.

Mr. Jones on the Origin of the Sliding-Scale.

On this subject an interesting letter from Mr. H. E. Jones appears to-day in our "Correspondence" columns. In this, he puts on record his recollections as to the initiation of the sliding-scale, and the adoption of it by the Commercial Gas Company, which recollections are confirmed by the volumes of the "Journal." It is a little strange that any question should have arisen concerning the point as to whom is due the credit for the origination of the sliding-scale. The "Times" is not infallible; and it so proved itself when attributing to Mr. Cripps the authorship of the sliding-scale as applied to statutory gas undertakings other than those working under a maximum price. If Sir George Livesey had not been the originator of the sliding-scale, he would have been the first to have said so during his lifetime, when, in print and otherwise, the credit of being so was placed upon him, and him solely. He was not in the habit of receiving personal credit unless merited; and, if anyone else was entitled to share credit with him, he never hesitated to say so. We shall hold Mr. Jones to his promise that, if he has time to go further into records, and they are of interest, he will place them at our disposal. His close association with the legislation of that momentous year for the gas industry, 1875, qualifies him for giving a personal touch to the information conveyed by the printed records, and to bring from behind the scenes much that imparts added interest to those records.

French Gas Consumers and Toluol Extraction.

Relative to the necessity of those engaged in the war to make the utmost of their toluol resources, it will be remarked with interest, from a report appearing in other columns, that the French Government are not giving the consumers of gas the opportunity of making a claim for compensation through price for any supposed injury occasioned by the extraction from gas of the substances required for war purposes. It is recognized by the French authorities that, used in incandescent burners and for heating purposes, there is no material or assessable injury occasioned to the gas, and that consumers using flat-flame burners have only to adopt incandescent ones to recoup themselves over and over again for depreciation of the luminosity of the gas *per se*. A Bill has therefore been introduced into the French Chamber to relieve gas undertakings from all liability owing to any contravention of their statutes or contracts due to any acts performed for the benefit of e State, and solely to meet military requirements. The Minister esponsible for the drafting of the Bill says: "If the matter is oked at from an equitable point of view, and by comparison ith the burdens imposed on the great majority of citizens by a tate of war, one is forced to the conclusion that an indemnity is ot justified, as it merely involves granting an indemnity to users f gas owing to the present position of their country." There are ther interesting points in the report; among them that Germany as taken the necessary steps to treat illuminating gas in the rincipal cities—a course which was adopted there long before e war in connection with coke-oven gas.

Question in Parliament.

In the House of Commons, Mr. Will Thorne, the Secretary f the Gas Workers' Union, has asked the Minister of Muni-ions whether he is aware that the loss in illuminating and eating power of gas caused by the extraction of benzol, toluol, nd xylol can be made good by the use of oil and cannel; and he will require gas undertakings to use artificial substances to aintain the quality of the gas or otherwise reduce the price to e consumers. Mr. Thorne evidently does not understand the xtent of the "loss" so far as incandescent lighting and heating urposes are concerned; nor does he appreciate that, at the pre-ent price of oil and cannel delivered, the cost of enrichment ould not be "worth the candle," and that, as a matter of fact, onsumers might have to pay a still higher price for their gas n account of the enrichment. Mr. Thorne has had an answer to e effect that the cost and difficulty of obtaining the enriching aterials required would restrict the possibility of adopting such rocesses, and that the deterioration of the quality of the gas s hardly appreciable.

as in Train Accidents.

No human being can do aught else than sincerely deplore uch terrible consequences as occurred in the railway accident at arrow. But there must be protest against the senseless ravings nd vapourings that one finds in non-technical papers and preju-iced electrical journals regarding the use of gas on trains involved such accidents. The public newspapers delight in obtaining sensational item, whether or not there is any real foundation or it; and the interested electrical papers think it their duty o foment bias and agitation notwithstanding that the founda-ion for what they are doing will not stand the test of technical nvestigation. In this Jarrow accident (as will be seen by the eport of the evidence at the opening of the Board of Trade nquiry), one guard stated that he "thought" gas was escaping rom the cylinders of the leading coach on the passenger train; nd another guard "thought" the gas was coming from the roof amps of the carriage as the roof was alight. An engine driver as unable to say what caused a jet of flame under the carriage; ut he "did not think" it came from the ashes of the engine. t is all particularly inconclusive testimony; but the evidence f Mr. A. C. Stamer, Acting Chief Mechanical Engineer of the North-Eastern Railway Company, helps us to test it. He stated hat one of the cylinders of the leading coach was burst at both nds, and lying at the rear of the engine; while the others had een staved in, or otherwise burst. All the low-pressure con-ections were broken away from the cylinders. This being so, ow could the jets of flame at the roof have been due to burning as? With the cylinders in the condition described, the high-ressure gas must have found speedy exit, and would naturally be at once dispersed. In an account published before the inquiry, one man stated that he noticed the smell of gas in the burning carriage. No doubt he did smell something, with the fumes from the engine about him. But has it occurred to those writers who have made use of this statement to condemn gas as to why, if there was gas imprisoned in, and mixed with the air of, the burning carriage, it did not explode with flames there? The amount of senseless talk there is on this subject is astonishing; and it is more so that the electrical papers should indulge in the folly of subscribing to it.

Sulphate of Ammonia Exports.

While coalowners and shipowners are engaged in the (to them) congenial task of skinning the gas industry, the industry, which is trying to do its best for everybody, including the Government, is being subjected to buffetings all round. We have local authorities and consumers asking for a reduction in the price of gas on account of the services being rendered in a common cause; coke consumers seem to think that an extravagant price is being asked for the commodity although the coal from which it is made is costing so much, and though in some areas there is not enough coke to meet the demand; tar, too, is not in particularly good market favour, and nobody wants much pitch; and now, after the Sulphate of Ammonia Manufacturers' Association have arranged with the Board of Agriculture to reserve for the British farmers a supply of sulphate of ammonia at a price much below the ruling market value, the "Times" attacks the gas industry through the Government because the latter have not prohibited the export of sulphate. But Mr. F. D. Acland has written to the "Times" pointing out the arrangement that had been made regarding price and reservation of supply. Mr. D. Milne Watson, the Chairman of the Sulphate of Ammonia Manufacturers' Association, also sent to our morning contemporary still more explicit information, which showed that the British farmers have so far taken less than one-fifth part of the quantity reserved for their autumn dressings. The "Times," however, has not seen fit to publish Mr. Milne Watson's letter dealing with this point. It is given in our "Correspondence" columns to-day.

Patents in Enemy Countries.

Some modification has been made by the Board of Trade, under powers reserved to them, in the Proclamations issued from time to time in relation to trading with the enemy. In the matter of the payment of patents, designs, and trade marks fees, the Board now give licence to persons residing, carrying on business, or being in the United Kingdom to pay on their own behalf or on behalf of any person or persons in the United Kingdom and on behalf of anyone in any other part of His Majesty's dominions who has been authorized to make such payments by the Government of that part of the dominions, any fees necessary for obtaining the grant or the renewal of patents or the registration or renewal of designs or trade marks, in an enemy country, and to pay to enemy agents their charges and expenses in relation thereto. The Board further give licence to persons residing, carrying on business, or being in the United Kingdom to pay on behalf of an enemy any fees payable in the United Kingdom on application for, or renewal of, the grant of patents or registration or renewal of designs or trade marks, and to pay agents in the United Kingdom (including themselves) their charges and expenses; also to pay on behalf of an enemy to any persons in any part of His Majesty's dominions outside the United Kingdom, subject to the authority of the Government of that place, fees payable on application for, or renewal of, the grant of patents or the registration of designs or trade marks in such part of His Majesty's dominions, and to pay such persons their charges and expenses.

Forthcoming Trade Exhibitions.

Among the various visible signs of a growing determination to secure what benefit may be possible for the manufacturers of this country as a result of the crippling of Germany's export trade, may be mentioned the industrial exhibitions organized by the Board of Trade. In May last, at the Royal Agricultural Hall, Islington, the Board arranged a British Industries Fair, at which large numbers of manufacturers and wholesale buyers were brought in contact, and visitors were able to see for themselves how much has been accomplished by British manufacturers in reviving certain branches of industry which had suffered severely from German competition. In fact, the success was such that the Board wasted no time before starting to make preparations for another display of a similar character in 1916. The arrangements for this Fair have been completed; and it is announced that it will be opened towards the end of February, in the buildings of the Victoria and Albert Museum, South Kensington. As on the previous occasion, admission will be by invitation of the Board of Trade alone, and will be restricted to *bonâ fide* buyers for the trades concerned. These trades (ones which have been more particularly the object of German competition) are limited in number, and include glass; and only British manufacturers engaged in them will be permitted to exhibit. Looking further ahead (but not too far, having in mind the importance of the end in view) an Industries of the Empire Fair is projected for 1917—not, however, this time by the Board of Trade, but by the British trade associations themselves. This it is intended to hold early in the year, in a building (having three-and-a-half times the total area of Olympia) to be erected for the purpose at Willesden Green. The idea is that it shall be the greatest trade exhibition ever organized, seeing that it will, as already mentioned, be the outcome of co-operative action on the part of the principal trade associations of this country. Unlike the first-named display, it will not be confined to particular trades, but will be open to British manufacturers generally; and it is hoped to have between two and three thousand exhibitors, representing upwards of seventy distinct trades.

THE LATE PROFESSOR LEWES.

An Appreciation by Sir Boverton Redwood, Bart.

Referring to the late Professor Vivian B. Lewes, in an article appearing in the "Petroleum World," Sir Boverton Redwood, Bart., shows a keen appreciation of the many sterling qualities of his, and our, late friend.

Vivian Lewes, he says, had a striking personality, which at once arrested attention. He ever had in view the silver lining of the darkest cloud; and he retained to the last a youthful buoyancy and sunny outlook which gave a charm to his manner and rendered him a delightful companion. Though of most amiable disposition, he was in matters of principle a good fighter; optimistic in the best and broadest sense; patient under reverses; and not unduly elated by success. He was modest as to his own attainments, and exceptionally generous in his recognition of the abilities of others. Probably his greatest gifts were his strong common sense, his intuitive perception of proportion, and his good judgment. Unquestionably, it was his possession of these qualities which rendered his advice on matters involving the application of science to industrial problems so valuable and so much sought after. Above all, however, he had a high sense of duty and of consideration for others. In all probability it was this feature in his character, coupled with unusual will-power, which brought about his untimely death; for when he left London for the last time to deliver a lecture in Wales on matters connected with the war, he was more ill than he recognized or admitted. He was urged not to go; but his characteristic reply was: "I have never disappointed an audience yet, and I cannot do so now." His illness, however, increased so rapidly that when he reached his journey's end he was in a state of collapse, and double pneumonia supervened. Thus he died, in harness, as he would doubtless have chosen to die, in the full vigour of his manhood, with the promise of many more years of useful service unfulfilled; and the world is the poorer.

Professor Lewes was universally recognized as a high authority on coal gas; and the lectures which he delivered on the manufacture and use of gas before the Gas Institute, the Institution of Gas Engineers, and the Royal Society of Arts, not only gave instruction in his inimitably delightful manner to the large audiences which they invariably attracted, but form an enduring record of his mastery of the subject. Nowhere was he a greater favourite than at the lecture table of the Royal Society of Arts. Presiding at the first of the course of lectures which he delivered before that Society during the present year on "Modern Munitions of War," Sir Boverton Redwood was, he remarks, able to inform an audience which filled every seat in the great room that since his first appearance there twenty-five years ago Professor Lewes, with the completion of the course, would have occupied the platform on no less than sixty occasions. He invariably lectured without using a single note, and was never at a loss for words. He possessed in a high degree the power of presenting scientific facts in attractive and lucid language, devoid of unnecessary technicalities, and enlivened by humorous allusions.

Scottish Junior Gas Association (Western District).—It was stated in last week's "Journal," on the authority of Mr. W. Grafton, that an adjudication had been made on last year's papers read before the Association, and that the two prizes had been awarded; but we learn now that the paragraph was based on a misconception. As a matter of fact, Mr. Grafton is one of five adjudicators appointed by the Council; and it is the opinion of the majority of these five that will settle who is to be awarded the prizes.

The Employment of Maimed Discharged Soldiers by Gas Undertakings.—The Director of the Strasbourg School for One-Armed Men, Herr Fritz Iwand, has communicated to the German Technical Press suggestions for the employment of men who have lost a hand or arm in the war. In regard to men who had been previously engaged in the gas industry, he says that, while the loss of a hand or arm will prevent them being employed again as machinists, stokers, or boiler men, they can well do duty as lamplighters, meter inspectors, &c. Outdoor work, he remarks, is more suitable than indoor work for men who have been so injured in the war; and people must accustom themselves to the sight of their one-armed and left-handed heroes.

ELECTRICITY SUPPLY MEMORANDA.

An Osram Defeat. The Osram lamp is not by any means having things all its own way. It seems to be an Osram belief that nothing has ever been done, or can ever be done, in connection with tungsten filaments that does not infringe the Osram patent rights. The result of this opinion is that anyone who essays to make a tungsten filament lamp, without paying tribute to the Osram people, will in all likelihood be called upon to answer for his temerity in the Law Courts. As we glance back, there appears to have been a perfect shoal of cases in which proceedings have been commenced to restrain infringement of the Osram patent; and, in various instances, the defendants have abandoned all defence, and given way before the Osram forces. Not so the Pope Electric-Lamp Company. They faced Osram Lamp Works, Limited, before Mr. Justice Joyce, and won. They faced their antagonists again in the Court of Appeal, and have sent the Osram Company home with the words of Lord Justice Bankes (supported by the Master of the Rolls and Lord Justice Warrington) humming in their ears, which words told them that, in the opinion of the Court, there is a substantial difference between the defendants' process of manufacture, and the process described in the plaintiffs' specification—in fact, the conclusion their Lordships came to was that the plaintiffs had failed to establish their case from whatever point of view it could be regarded. It is for the Osram people an unpleasantly decisive statement of opinion. Under the patent being worked by them—that granted to Dr. Alexander Just and Franz Hanaman—the filaments are made of pure tungsten by mixing finely divided tungsten with a binding material, which causes the cohesion of the particles, so forming the filaments from the mixture, and then carbonizing them. The defendants pointed to what they contended were distinct differences in the processes of manufacture, inasmuch as in their case they do not carbonize the filaments, and do not pass an electric current through them, but heat them in an electric furnace; and, further, they do not use an atmosphere of steam and hydrogen, and do not equalize the filaments. It was also pointed out that the making of filaments with tungsten was old. The Court, as already stated, cordially agreed with the defendants that their patent does not infringe the Osram one. Now we suppose Osram Lamp Works, Limited, are ruminating over the question of whether they shall go to the House of Lords, or whether they had better leave things as they are.

Coal Supplies. The "Electrician" states that already reports are being received from various parts of the country which show there is considerable difficulty in getting coal supplies through to generating-stations; and coal reserves are being eaten into more rapidly than is comfortable for the peace of mind of the managers. In one case, it is stated, the deliveries are so deficient in relation to current needs that a stock of 20,000 tons of coal is being shipped away at the rate of 1000 tons per week. During the autumn, electricity stations, as well as several other important works which we need not name, were warned that the winter would be a difficult one in respect of coal supplies, and that, in consequence, stocks had better be accumulated betimes to an unprecedented amount. It is these greater stocks that were, or should have been, put by when there was the opportunity that are being drawn upon at the present time. Then why grumble? However, the "Electrician" says that the railway companies are more to blame for the shortage than the collieries, and that the present position is sufficiently serious to demand the immediate action promised by the Board of Trade. What was the nature of the action promised by the Board of Trade? We did not know that the Board were in the position to promise anything very definite in the way of remedy. They were suggesting the pooling of privately owned railway waggons, and having their comings and goings regulated in the general behoof. But if this plan (which is not going to mature just yet) is eventually carried out, the country will have to thank the Luton Town Council for contributing to the common stock fifteen new railway waggons which they propose to purchase in order to secure coal for the electricity works. Of course, we do not think this would be fair; but if the pooling scheme is carried through, all must share and share alike. "It is quite certain," says the "Electrician," "that those who are responsible for the delivery of coal to electricity supply stations do not fully realize the extent of their responsibilities, or there would not be the present shortage." There is more in the present position than a mere failure to recognize responsibilities; and, if our electrical contemporary will start on the job, it will find the coal industry, its men, and its methods combine to make a most interesting study.

An Acute Position. There is the "Electrical Times" too. It asserts that the coal position is a very hazardous one. "There are," it said at the time of writing last week, "at least three electric stations in London that are short of coal." During the preceding week-end [Dec. 18] one of those stations had a supply for less than a fortnight, another for only three weeks, and the other for only a month. Our contemporary asks, "What has brought us to this pass?" and it replies: "The most salient fact is that the Price of Coal (Limitation) Act, 1915, reacts against home supplies with articular severity. This Act sets a limit to the price at which oal may be sold for home consumption. There is no such limit o the price of coal sold for export; therefore it pays the col-eries far better to sell abroad. That may be unpatriotic of them ndividually; but it was bound to occur under competitive busi-ess conditions." Then later on it is submitted that the Act hould be amended, so as to restrain the strong temptation to hip abroad. Our contemporary seems to have overlooked the oal Exports Committee, and the principles that are guiding them n their operations. They are seeing first that there is sufficient oal for home needs; second, are looking after our Allies before eutral countries; and, third, are keeping a strict eye on the ex-ort of coal to neutral countries. The "Electrical Times" should tudy the Board of Trade returns; and it will see the consider-ble drop there has been in the exports to neutrals. Under the ircumstances, we rather think it has been writing without being n intimate touch with the facts. It is true the coal owners are ot limited in the price they can ask for coal for abroad; but ney cannot send coal out of the country save under licence from ne Coal Exports Committee. This Committee are, under the ircumstances, a necessary supplement to the Act. However, esides the suggested and unnecessary amendment of the Act, ne remedies proposed by our contemporary are that the num-er of available steamers should be increased, and that Govern-nent pressure should be brought to bear on coal merchants to ause them to give power stations supplying munition works pre-erential treatment. We repeat the question, What did the elec-ricity supply stations do during the summer, when freights were ower than now, and supplies more plentiful, to protect themselves gainst a condition of things as to the probability of which there vas warning? The trouble does not apply to London only. The Ianchester Corporation Electricity Department have had de-veries reduced by 50 per cent., and the stock of 21,000 tons that xisted at the end of July is down to 12,000 tons now.

Lamp Comparisons.

There has been a fairly good absence for some time of the entertaining comparisons made by electricians as to the relative osts of gas and electric lighting. But there is a little breaking-ut again. Messrs. Johnson and Phillips, Limited, are the authors f a fresh comparison, which naturally puts high-pressure gas out f the running, gives to the so-called "half-watt" lamps second lace, and the lead is easily taken by the "Metroflam" arc lamp vhich (this is, of course, quite between our readers and ourselves) Iessrs. Johnson and Phillips produce for the market. In these lays, we do not see many of this particular brand of lamp about; nd this is very remarkable in view of the character that the firm n question modestly give to it. But perhaps even electricians vho are buyers of arc lamps, and have a capacity for making omparisons, are inclined not to take everything for granted that eaches them from electrical sources. The comparison is as to he cost of running one 2000-candle power lamp for 1000 hours. The "Metroflam" lamp is an 8-ampere one, running five in series, n 220 volts direct current. Here is the comparison:

Metroflam Arc Lamp.—Carbons 15s. 6d.; current at 1d. per unit, £1 10s.; labour, 5s. . . . . . . Total	£2 10 6
Half-Watt Incandescent Lamp (Life 800 Hours).—Renewal of lamps, £2; current, at 1d. per unit, £4 3s. 4d.; labour, breakages, &c., 2s. 6d. . Total	£6 5 10
High-Pressure Gas-Lamp.—Gas at 2s. per 1000 cubic feet compressed, £8; mantles, &c., 8s. 4d.; labour, &c., 5s. . . . . Total	£8 13 4

Now electrical men would be very glad to know that they could get a flame arc lamp of an actual 2000-candle power to run for 1000 hours for £2 10s. 6d.; and gas people would be very sorry for themselves if working costs for a 2000-candle power high-pressure lamp mounted up to £8 13s. 4d. per 1000 hours. If these figures were true, then the electrical people would be able to take contracts for arc lamps at a much lower price than they do; while, on the other hand, gas undertakings throughout the country would in out-of-war times be losing money hand-over-fist on the high-pressure lamps they have on contract. Working-out the current consumption, it is seen that, for the 2000-candle lamp, it is only put at 352 watts per hour. The consumption is about right, calculating on amperage and voltage; but the efficiency works out to the extraordinary figure of 5·7 candles per watt! The electricians would like to see this photometrically demonstrable. These lamps, too, have modest appetites for carbons, which only work out to 0·186d. per hour. As to labour, well, we will not quarrel with that, as the firm take the same figure for high-pressure gas-lamps. They also attribute an efficiency of 1 candle per 0·5 watt for "half-watt" lamps, which they ought to know is photometrically untrue. But what is still more untrue, and quite unworthy our competitors, is that they declare that to obtain 2000-candle power with high-pressure gas-lamps requires a consumption of 80 cubic feet of gas per hour, which represents an efficiency of only 25 candles per cubic foot, while there are low-pressure gas-lamps that will give them an efficiency equal to this without the trouble of compressing the gas. We believe that with the Keith lamp a guarantee of 2000-candle power would be given on a consumption of 33½ cubic feet of gas of (say) about 500 B.Th.U.—a vast difference from the absurd statement given in the electrical comparison. In the comparison, there is nothing allowed for depreciation of light through the need, with the high-power electric lamps, and their eye-injuring intrinsic brilliancy, of screening the source of light; while with the large area surface of the high-pressure gas mantle, the intrinsic brilliancy being relatively low, there is consequently not the same necessity for largely cutting down the light by globes or screens.

Varied Power.

It was an excellent practical paper that Mr. W. A. Tookey read before the Junior Institution of Engineers yesterday week; and we are afraid that parts of it will not be altogether agreeable reading for our electrical friends. The author has a little tilt at them over the variety of power that is to be found in some generating stations. The one which he puts forward as illustration must surely be an exception for variety. The main motive power is steam; but there is a generating set driven by suction-gas plant, another by a Diesel oil-engine, and a third by a town-gas engine. The mechanic who can deal with such a mixed collection as this must be a paragon. But while Mr. Tookey twits the central station engineer (with whom we are not siding for his hybrid plant), the latter can turn round and say that in variety there is safety, and that he can change and change about just as economy dictates, though the economy to be so gained must be more than wiped out by what is entailed by having four different plants with which to deal. For instance, there is different fuel to be bought and stored for the steam, suction-gas, and Diesel plants. The town-gas engine is the only one of the quartette that does not cause the engineer any worry in regard to fuel purchases, market prices, storage, and labour in the operations preceding the development of power by the prime mover. But Mr. Tookey points out that it is unfortunate that, though the gas-works is the only place where the utmost value is derived from the coal used, the gas is produced at such a cost as to make its use only commercially practicable for relatively low-power engines. This is due to the limitations imposed by the variety of uses to which the mono-gas supply is put. If clean gas of lower grade than that which is most serviceable for domestic use were available from the gas-works, gas would have very much larger application for engine purposes. There are gas-works that have parliamentary authority to supply power gas (gas of lower grade than the ordinary supply); and possibly a dual supply of gas in industrial areas will be a development in the future.

Power Costs.

But on the point of costs, the electrical people will not bless the name of Tookey, though he deals very fairly with the relative positions of electric-motors and gas-engines. The former has advantages which the latter does not possess. Adaptability and convenience must go a long way; but "usually the cheaper operating cost of the gas-engine determines that of the two it is preferable for purely commercial reasons." Gas-engines have been wonderfully improved. In the early days, the compression pressure rarely exceeded 50 lbs. per square inch; but compression pressures more recently have been in the neighbourhood of 120 lbs., and even 150 lbs. The average engine demands 19 cubic feet of 500 B.Th.U. gas per B.H.P.-hour. With the price of gas for power purposes at 20d. per 1000 cubic feet, the cost of generating 1 B.H.P. hour would be 0·38d. Then taking the load at five-eighths of the full load, with a motor about 0·89 unit would be consumed per B.H.P. hour; and therefore, to secure similar results, this should be procurable at the same price as the 19 cubic feet of gas. To be equivalent to gas at 20d. per 1000 cubic feet, electric energy would have to be sold at 0·427d. per unit. In other words, electric current for motor purposes at 1d. per unit, may be taken as being equivalent to gas at 46d. per 1000 cubic feet. That is not a comfortable comparative condition. On the other hand, in initial costs the electric-motor has first place. The example taken by Mr. Tookey is a 20-horse power machine. A motor of this power fixed would cost about £60; a town-gas engine of equal output would cost nearly double; and a suction gas-engine and producer nearly three-and-a-half times as much. The town-gas engine should be debited with £6 per annum as additional standing charges to cover higher depreciation and interest; while the suction-gas plant should be debited with an additional £15 for the same reason. The suction-gas plant is shown to be "out of it" compared with the town-gas engine; but, in comparison with the electric-motor, the town-gas engine, through economy in running, would soon rub out any difference in the additional standing charges. As to the suction-gas plant (the facts concerning which are pretty well known now, and not to its advantage, unless in a district where town gas is very dear), about 2 lbs. of anthracite are required to generate the equivalent of 1 electrical unit of energy. The average cost of generating a unit of energy with suction-gas engines and plant (Mr. Tookey says) does not fall far short of 0·75d. per unit, when all charges are brought into account, with anthracite at 34s. per ton. In other words, while the cost of fuel is only about 0·375d. per unit, the other expenses usually amount to about as much again. The figures supplied by Mr. Tookey are good for competitive purposes.

The Chairman (Mr. Arthur R. Ling), at the last ordinary monthly meeting of the London Section of the Society of Chemical Industry referred to the loss the Society had sustained by the death of Professor Raphael Meldola and Professor Vivian B. Lewes. Professor Meldola, he said, was one of the Society's most illustrious Past-Presidents; and the loss of him to the country at the present time was very serious.

THE "JOURNAL" AND THE ORIGIN OF THE SLIDING-SCALE.

Mr. Hunt's Oblique Retort.

The circuitous course of replying in the columns of the "Gas World" to the editorial article that appeared on the above subject in the "Journal" for the 14th inst., and which article had not been published in the columns of our contemporary, has been chosen by Mr. Charles Hunt. Indirect action of this kind is singular, and quite foreign to Mr. Hunt's usual observance of the dictates of courtesy. However, there is palliation in his admission that, whatever may have been the attitude of the "Journal" towards the sliding-scale in 1875, "the memory of bygone time has been far more than completely effaced by the important services which have since been rendered by your contemporary to the cause of the sliding-scale for more years than I care to remember." We appreciate very sincerely this testimony from Mr. Hunt. At the same time, we cannot help feeling—although not immediately responsible for the editorial articles that appeared in our columns in 1875—that we are presented with something in the nature of a psychological phenomenon when we are told that "the *memory* of this bygone time has been *far more than completely effaced*," and yet, earlier in the month, the writer of these words bluntly asserted, without any qualification whatever, the strong opposition of the "Journal" to the "innovation" of the sliding-scale. The words and the act are, at any rate, a distinct contradiction. Again, Mr. Hunt now declares that, if he had thought for a moment that his statement as to our early attitude towards the sliding-scale could be at all open to question, he would not have made it, "since it was neither my intention nor desire to reopen *forgotten* controversies." The act of recalling, and the words "strongly opposed," hardly support the profession as to intention or desire. Nevertheless, we accept the present statement in the spirit in which it is believed it has been offered.

But Mr. Hunt proceeds to attempt to justify the assertion as to the "strong" opposition; and he does this by asking his readers to peruse what the "Journal" said in one half of the year 1875, and then, completely discharging their minds of the *terminus a quo*, read what was said later in the year, and consider only the *terminus ad quem*. By this process, they would see that there had been a complete editorial *volte-face*. But we rather think that the 1875 readers of the "Journal"—or all but one of them—who were in intimate touch with the whole of the circumstances of the times must have read the articles in the second half year with present in their minds the arguments that had been advanced earlier, and it is by the aid of what was said in the first half that interpretation must be given to what was said by the writer in the second half. Mr. Hunt himself admits that the "Journal" in the first half of that eventful year 1875 "expressed itself as being in favour of a sliding-scale that should operate *both ways*." But he seems to fix the change in attitude as occurring in our issue of June 15 of that year, when, he says, there "came the announcement of the 'Journal's' adherence to the declaration which had already been made on behalf of the associated companies against any sort of sliding-scale of dividend." This does not exactly express what was then said, and it carefully omits some important passages. We quoted these on the 14th inst. But let us do so again:

> We gather from the speech of Sir E. Beckett that the "associated companies" object to any sort of sliding-scale of dividend; and so, in fact, do we. We only support the up-and-down scale as a simple measure of fairness. *If a company are to be fined, for that is what it practically comes to, when they exceed one price, it is but just that they should be rewarded when they make another and lower charge.*

Mr. Hunt omits the final passages. But what objection can be raised to the attitude there expressed? They are not the words of a writer "strongly opposed" to the "innovation" of a sliding-scale. These and other statements have a distinct bearing upon the articles that succeeded; and they indicate the extent to which, and the objects for which, the "Journal" was contending, at the inception of new legislation, in relation to the circumstances of the time, and the conditions and experiences preceding. We repeat that it is clear, taking the articles as a whole and not piecemeal, that opposition was more directed to the terms than to the "innovation," and that the use by Mr. Hunt of the words "strongly opposed" is not justified.

In a note appended to Mr. Hunt's letter, it is remarked, "That our contemporary should take this up thus rancorously is passing strange." Those of our readers who have perused our editorial article of Dec. 14 (which article was solely written with the view of not allowing Mr. Hunt's statement to spread the notion that at one time the "Journal" was bitterly opposed to a sliding-scale of price and dividend of any sort) will be rather puzzled to make the term "rancorously" fit what was then written. Neither in the matter of the applicability of terms nor in that as to what constitutes courtesy is judgment the monopoly of any single person either westward or eastward; and we confidently leave judgment on these points to our readers.

Since the appearance of the letter which has called for these comments, it has been suggested to us that the "dig" at the "Journal" of forty years ago, and the indirect course adopted of replying to our editorial article of Dec. 14, may have some connection with a little discussion of not long since on the subject of South Suburban meter-rents. Lest any others should think this, let us say at once that we do not believe that any such little difference of opinion on a question of policy would lead Mr. Hunt to take a vindictive course. This matter would not have been referred to, but, having been mentioned, we should like it to be understood that we emphatically dissociate ourselves from any such view.

PRESENTATION TO MR. NORTON H. HUMPHRYS.

A pleasing little ceremony took place at the Salisbury Gas-Works on the 23rd inst., when Mr. Norton H. Humphrys was requested to meet the employees in the general office during an interval between the retort-house charges—a time that would admit of the whole number being present. Mr. William Fielden (Engineer and Manager of the Company) presided, and after recounting the circumstances that had resulted in the gathering that afternoon, called on Mr. J. C. Watts, the oldest employee of the Company and Works Foreman, to address the meeting.

Mr. Watts said that personally he felt it a great privilege to be deputed to voice the views that had led up to the meeting that day. Many of the staff had enjoyed the advantage of being associated with the late Engineer and Manager for quite a long period. One or two, himself among the number, could remember welcoming him on his arrival in Salisbury in 1883; and they all felt that his connection with them should not be closed without some recognition of the good feeling that had at all times existed between them. Consequently, he now had the great pleasure, on behalf of the whole working staff, he believed without one exception, of asking Mr. Humphrys to accept, with their best wishes, an illuminated address, together with an umbrella for Mrs. Humphrys, whom they thought ought not to be forgotten on the present occasion.

The address, which was mounted in a handsome carved oak frame, and was beautifully executed in gold and colours, was as follows:

> Presented to Norton H. Humphrys, Esq., Assoc.M.Inst.C.E., F.C.S., by the undermentioned Officers and Staff of the Salisbury Gas Light and Coke Company on his retirement, after 32 years' service, as a token of their regard and appreciation of his many thoughtful acts of kindness to them, with every good wish for his future health, happiness, and prosperity.
> 30th September, 1915.

It also bore the names of the subscribers. The handle of the umbrella was mounted with gold.

Mr. J. W. Frost (Accountant), Mr. T. Crowdy (Manager's Assistant), Mr. G. Bowering (Outdoor-Foreman), and others having spoken in similar terms,

Mr. Humphrys (who was enthusiastically received) said he could not find words that would adequately express all he would like to say, on receiving from his old friends such a splendid recognition of their regard and esteem, which was accepted with as much pleasure as they had expressed in presenting it, and would always have an honoured place in his home. Mrs. Humphrys was not yet aware of their kindness to her; but he was sure he could say, on her behalf, that she would also be very much pleased with the handsome and useful present, and would value it highly. He did not forget that these presentations had been made at a time when they were all occupied with matters of much greater moment, and also when there were many extra expenses, and the necessaries of life were costly, so that it was not so easy to find an extra shilling, as it would be under happier circumstances. He thanked Mr. Frost for undertaking the necessary arrangements, and the several speakers; and also Mr. Fielden for presiding.

The awards of premiums made by the Society of Engineers in respect of papers published in the "Journal" of the Society during 1915 included the President's gold medal to Mr. Arthur H. Barker, B.Sc., for his contribution entitled "Some Future Developments in Heating and Ventilation;" and a Society's premium, value £3 3s., to Mr. Sydney G. Turner, Barrister-at-Law, for his paper entitled "Law and Engineering, Some Points of Contact." These papers were noticed in the issues of the "Journal" for May 18 last, p. 402, and Oct. 12, p. 91.

Captain G. H. Coates, of the 9th Durham Light Infantry (Foreign Service Battalion), died very suddenly at Darlington on Christmas Day. An old territorial, Captain Coates rejoined for foreign service shortly after the outbreak of war, and the cause of his death from heart failure is to be found in overstrain as a consequence of his arduous military duties. For many years Captain Coates had been associated quietly, but effectively, with the large undertaking built up by his father, the late Mr. Thomas Coates, at the Whessoe Foundry, Darlington. He was attached more to the commercial side of the business, though he had been trained as a civil engineer, in which capacity he had done valuable work in different parts of Europe. He was Joint Managing-Director with his brother (Mr. Alfred T. Coates) of the Whessoe Foundry, and was only 41 years of age. He was a keen sportsman, and popular in society. He leaves a widow and five children.

EVAPORATION OF NAPHTHALENE IN AIR AND COAL GAS VAPOURS.

An Investigation in the Physical Laboratory of the South Metropolitan Gas Company.

By the courtesy of Mr. Charles Carpenter, D.Sc., we are enabled to publish a particularly interesting record of the results of an investigation on the above subject which has been conducted in the Physical Laboratory of the South Metropolitan Gas Company. To the work the signature of Mr. J. S. G. Thomas is appended. It should be explained that this only deals with the first part of the research that has been undertaken. We are sure it will be hoped by our readers that, when the results of the further prosecution of the research are available, we shall have the opportunity of presenting them to our readers for the general benefit of the industry. The publication of records of work of this kind adds further to the indebtedness of the profession generally to the South Metropolitan Gas Company.

A knowledge of the vapour pressure of naphthalene in coal gas s of extreme importance to gas engineers and those concerned with the distribution of coal gas. The amount of naphthalene required to saturate any given volume of gas can be at once calculated from the knowledge of the vapour pressure of naphthalene n the gas.[*] The method of evaporation for the determination of the vapour pressure of naphthalene presents numerous advantages over the barometric method. This method has been previously employed by R. W. Allen[†] and by E. Schlumberger.[‡]

The method, in theory, is extremely simple. It consists merely n passing a known volume of air or other gas over a weighed amount of naphthalene, and determining by difference the amount of naphthalene which evaporates. It is necessary to ensure that the gas passes sufficiently slowly to become saturated. Allen and Schlumberger both employed the evaporation method, and the former attained confirmatory values by the barometric method.

Schlumberger labours under a misapprehension when he states that Allen's values at lower temperatures are extrapolated from the values at higher temperatures. Allen determined the vapour pressure at 15°, 30°, 45°, 60°, and 75° C. by the evaporation method, and at 0°, 39°, 46·8°, 80·4°, 100°, 116°, and 130° C. by the barometric method. Schlumberger confined his experiments to the region of temperature 0° to 50° C. The results obtained by Schlumberger between 0° and 30° differ appreciably from those obtained by Allen over the same range. Above 30° C., the values obtained by both observers agree within the limit of experimental error.

At 0° C., Schlumberger obtained the value 0·006 mm. as the vapour pressure of naphthalene; while Allen's value is 0·022 mm. —a value almost four times as large. Although neither pressure can be regarded as large, the difference in the amounts of naphthalene carried by the quantity of gas manufactured per day by one of our large gas companies, as calculated from the respective results at 0° C., is very considerable. The difference will be appreciated by those concerned with the distribution of coal gas; Allen's value at 0° C. being practically identical with that found by Schlumberger at 10° C.

Owing to the differences existing between the experimental results of these observers, it seemed an essential preliminary to the determination of the vapour pressure of naphthalene in various vapours to redetermine the vapour pressure in air and coal gas, either of which is to be used in succeeding experimental work.

Preparation of the Naphthalene.

This was prepared from what was described as pure naphthaene. The sample was alternately digested with sulphuric acid and caustic potash several times—being washed with water between each digestion. The purified sample was three times distilled in steam, drained free from water, sublimed, powdered, and set to dry *in vacuo* over concentrated sulphuric acid for about six weeks. The melting point of the sample was 80·2° C.; and when boiled with concentrated sulphuric acid, it gave a very slight coloration.

Apparatus and Method of Experiment.

The method of experiment was similar to that employed by Allen and Schlumberger. A rectangular bath of tinned copper, 2 ft. 9 in. long by 10 in. deep by 6 in. wide, was constructed. The water in the bath was heated by luminous burners; the temperature being regulated by a gas-regulator of the type described and used by Perman.[*] The regulator was found very efficient over the range of the temperatures employed. The temperature rarely varied more than 0·01° C. during an experiment; and I believe the maximum temperature error in any experiment does not exceed 0·03° C.[†] The temperature of the water in the bath was indicated by the thermometer T (fig. 1, below), which was standardized under the conditions of use at the National Physical Laboratory. The stem of the thermometer was surrounded by water sucked up from the bath into the tube L; the tube itself being wrapped with a thick layer of cotton wool. Readings of temperature were taken by means of a "reader;" and all temperatures were reduced to the hydrogen scale. The water in the bath was thoroughly stirred by two stirrers S_1 S_2, connected to pulleys P_1 P_2; the pulleys being driven by a small hot-air engine. The stirring was very efficient; and no difference of temperature could be detected when the thermometer was placed at various parts of the bath. No difference of temperature, likewise, could be detected when the water in the tube L was renewed.

The gas employed (air or coal gas) entered through the wash-bottle A containing concentrated sulphuric acid. B is a mercury gauge, inserted to measure the pressure of the gas, and to ascertain that the pressure was not appreciably different from atmospheric. The gas was further dried by passing up the tower C, filled with pumice moistened with sulphuric acid, and over the calcium chloride contained in the U-tube D. Dust was filtered out of the gas by the plug of cotton wool contained in E. The gas then passed through a length of 10 feet of glass tubing (represented diagrammatically at F), so that the gas attained the temperature of the bath. G was a vessel of tinned copper, 10 in. by 6 in. by 1 in., which was closed-down with a lid of tinned copper, fastened down water-tight by screws. A layer of rubber ⅛-inch thick was placed between the lid and the top of the vessel. The vessel contained the tube H, filled with calcium chloride kept in place by plugs of cotton wool. In G were likewise contained the U-tubes J K filled with naphthalene. The gas was passed successively through H, J, and K.

It is evident that the amount of naphthalene absorbed by the gas (up to complete saturation) at any given temperature depends upon the time the gas is in contact with the naphthalene. This time can be lengthened by employing more tubes containing naphthalene arranged either in parallel or in series, or by aspirating the gas more slowly. In preliminary experiments, it was found that employing three tubes containing naphthalene, the absorption occurring in the third tube at 20°, 30°, and 50° C. was invariably less than could be detected by a balance sensitive to one-tenth of a milligramme when a rate of flow of gas of about 4 litres per hour was maintained. The third U-tube was therefore abandoned, and two tubes J K alone were employed.

The gas after passing through K was passed into the wash-bottle M containing sulphuric acid, where the naphthalene was re-absorbed. The gas then passed into the aspirator, which had a cubical capacity of 36 litres. In most of the experiments a volume of 24 litres of gas was aspirated through the apparatus;

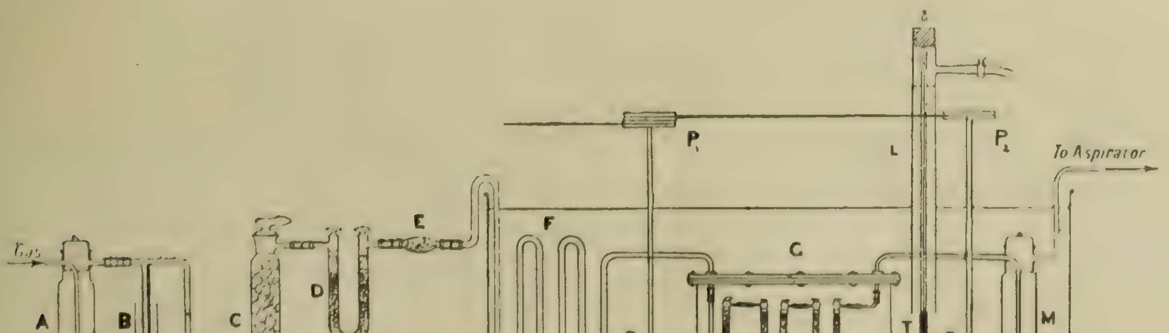

FIG. 1.—THE APPARATUS EMPLOYED.

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[*] Ostwald-Luther, "Physico-Chemical Measurements," p. 114.

[†] Allen, "Journal of the Chemical Society," 1900, pp. 400 to 412.

[‡] Schlumberger, "Journal für Gasbeleuchtung," 1912, pp. 1257 to 1259.

[*] Perman, "Evaporation of Water in a Current of Air," Proceedings of the Royal Society, Vol. LXXII., 1903, p. 74.

[†] An exception must be made of the case of the measurement at 12·98° C. The bath in this case was kept filled by a current of tap water. The thermostat was not used; and a maximum variation of about 0·3° C. occurred during the course of the experiment.

a larger volume being aspirated at the lower temperature. Thus at 0° C. the volume aspirated was 83 litres. Air at 65° C. was aspirated through the apparatus for three hours before commencing the series of tests.

The volume of gas employed was corrected for: (1) Temperature—all volumes were calculated at a temperature of 15° C. and all temperatures were reduced to the hydrogen scale; (2) humidity—the pressure of water vapour was taken from Kaye and Laby's tables, and the partial pressure of the gas obtained by subtraction from the total pressure; (3) pressure—all volumes were calculated at a pressure of 760 mm. of mercury.

METHOD OF CALCULATION.

T being the absolute temperature of the gas at which its volume V is dermined, m the molecular weight of naphthalene, g the weight of naphthalene carried by the volume V of gas, the pressure of the naphthalene is given by:

$$p = \frac{62290\, g\, T}{m\, V}$$

In the present experiments $T = 288$ and $m = 128$. Then g was always calculated for a value of $V = 1$ litre of dry gas at 15° C. and 760 mm. pressure.

RESULTS OBTAINED.

The results obtained are set out in tabular form herewith. The results could always be repeated with an agreement of 2 per cent.; and this accuracy is claimed for the experimental results.

Table I. gives the experimental results obtained; temperatures being corrected to the hydrogen scale.

TABLE I.

Temperatures. ° C.	Vapour Pressure. Air. Millimetre of Mercury.	Vapour Pressure. Coal Gas. Millimetre of Mercury.
0	0·00538	—
12·98	0·0233	—
19·86	0·0500	—
24·80	0·0845	0·0837
29·62	0·128	—
34·60	0·218	0·217
39·70	0·320	—
44·86	0·526	0·534
49·94	0·801	—
59·76	1·780	—

The values obtained when using coal gas are seen to agree with those obtained when the naphthalene evaporates into air.

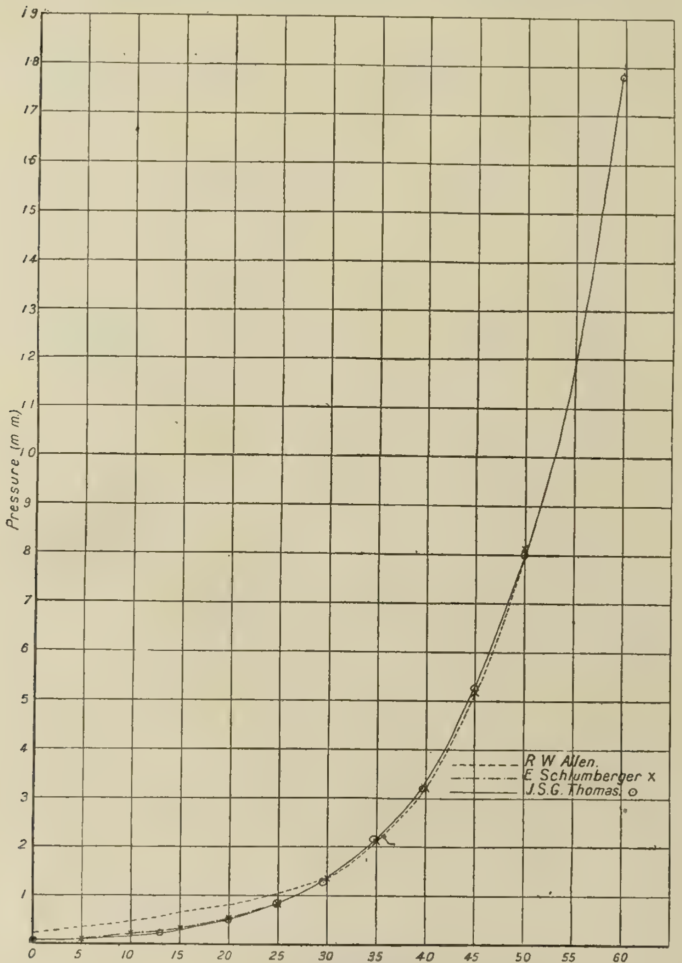

Fig. 2.—Three Sets of Results Compared.

The experimental results are plotted graphically in fig. 2. The results obtained by Allen and Schlumberger are also shown on the same diagram.

DISCUSSION OF RESULTS.

A consideration of fig. 2 indicates that at temperatures above 30° C. the observations of Allen, Schlumberger, and the author of the present work are in practical agreement—what little differences exist being probably due to experimental error. This may be gathered from the fact that at 45° C. the value obtained by Schlumberger is less than the value obtained by the present author; the reverse being the case at 50° C. Allen's values, however, are uniformly lower (though very little lower) than the values obtained in the present experiments between 30° and 50° C.

The important parts of the curves relate to observations made at temperatures below 30° C. Here it will be seen the values obtained by Allen are very considerably in excess of the values obtained by Schlumberger and myself; the values obtained by the two latter being in practical agreement. The difference between Allen's values and the values obtained by me cannot be ascribed entirely to experimental error. An examination of Allen's results shows a consistency of about 2 per cent. among individual results at any different temperatures. In seeking an explanation of the discrepancy, three possible causes present themselves.

(1) The possible presence in the naphthalene used by Allen of an impurity more volatile than naphthalene below 30° C. In the series of experiments by the present author, precaution was taken to remove any more volatile impurity by the prior aspiration of air at 65° C. for some hours over the naphthalene.

(2) The possibility that, at temperatures below 30° C., the gas employed did not attain the temperature of the bath. Allen did not heat the gas to the temperature of the bath prior to its entering the naphthalene tube. In Schlumberger's and the present author's experiments, this precaution was taken. To see how far this might influence the results obtained with the present apparatus, experiments were performed at a temperature of about 15° C.; the gas being in the one case preheated and in the other not. The air temperature was 21·7° C. A difference of, roughly, 2 per cent. was obtained; the preheated gas giving the higher result. The possibility of the atmospheric temperature in Auckland, New Zealand, being higher than in London was taken into consideration, by heating the gas to 35° C. by means of a water-jacket prior to its entering the naphthalene tube, which was at about 15° C. In this case likewise the difference found was within 2 per cent. A knowledge of the dimensions of Allen's apparatus would help one to realize more exactly the experimental conditions of his work. It is possible that less time was allowed the gas to attain the temperature of the bath than was the case in the experiments here cited.

(3) A third explanation may consist in the possible polymorphism of the naphthalene at temperatures below 30° C. This explanation was suggested to the author by Professor Henry E. Armstrong, F.R.S.

The experimental results obtained, and given in Table I., can be well co-ordinated by means of a formula of the Kirchoff-Rankine-Dupré type:

$$\log p = A + \frac{B}{\theta} + C \log \theta.$$

Logarithms being taken to base 10, and temperatures θ being expressed on the absolute scale, the values of the constants being determined from the observations by the method of least squares, the observations being weighted according to their proportional accuracy, we find:

$$A = 11·7797$$
$$B = -3812·34$$
$$C = -0·02593$$

So that

$$\log p = 11·7797 - \frac{3812·34}{\theta} - 0·02593 \log \theta.$$

A comparison of experimental and calculated values is given in Table II.; the differences being given in the fourth column.

TABLE II.

Temperature. ° C.	Vapour Pressure (Millimetre of Mercury). Experimental.	Vapour Pressure (Millimetre of Mercury). Calculated.	Difference. Experimental—Calculated.
0	0·0054	0·0056	−0·0002
12·98	0·0233	0·0243	−0·0010
19·86	0·0500	0·0499	+0·0001
24·80	0·0845	0·0820	+0·0025
29·62	0·128	0·131	−0·003
34·60	0·218	0·209	+0·009
39·70	0·320	0·334	−0·014
44·86	0·526	0·527	−0·001
49·94	0·801	0·812	−0·011
59·76	1·78	1·81	−0·03

Table III. gives the value of the vapour pressure of naphthalene between 0° and 60° C. at intervals of 5° C., calculated by the above formula; and in the last column is given the amount of naphthalene in grains to saturate 100 cubic feet of dry coal gas at the various temperatures—the volumes of gas being throughout measured at 15° C. and under a pressure of 760 mm. of mercury.

Fig. 3 is a graphical representation of the results given in the third column of Table III. This is the form in which the experimental results will be of most value to those concerned with the manufacture and distribution of coal gas. Curve A represents the results over the range of temperature 0° to 60° C. Curve B refers to the range 0° to 30° C.; it being possible in this case to choose a very much larger scale of ordinates, in order that from

TABLE III.

Temperature. °C.		Vapour Pressure. Millimetre.		Grains of Naphthalene to Saturate 100 Cubic Feet of Dry Coal Gas Measured at 15° C. and 760 Millimetres.
0	..	0·0056	..	1·75
5	..	0·0101	..	3·15
10	..	0·0176	..	5·49
15	..	0·0301	..	9·39
20	..	0·0506	..	15·8
25	..	0·0836	..	26·1
30	..	0 136	..	42·4
35	..	0·218	..	68
40	..	0·343	..	107
45	..	0·533	..	166
50	..	0·816	..	254
55	..	1·23	..	383
60	..	1·84	..	574

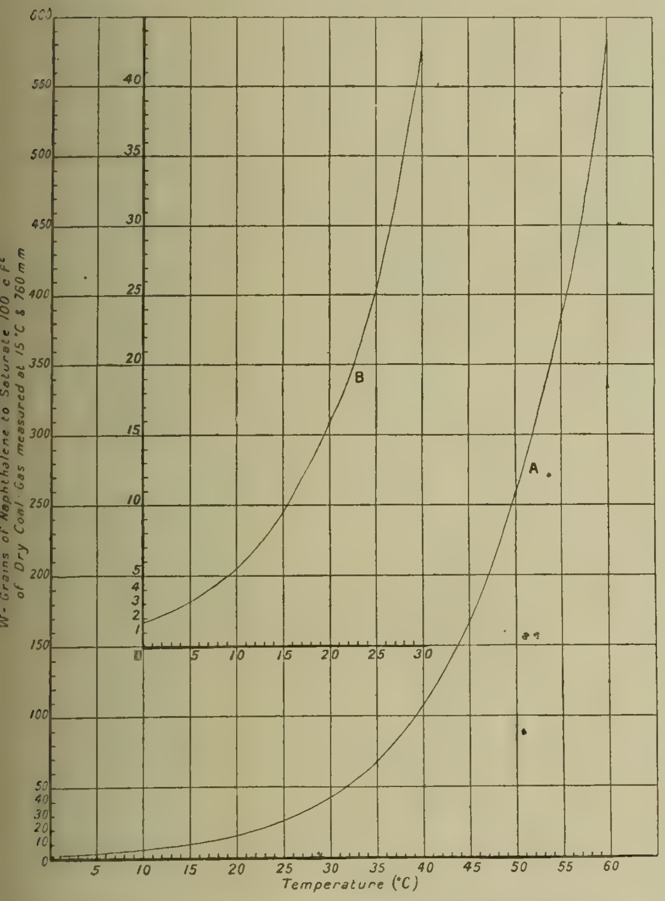

Fig. 3.—Grains of Naphthalene to Saturate Gas under Different Conditions.

Curve B the saturation values can be accurately read over the important range of temperature 0° to 30° C.

The number of grains W required to saturate 100 cubic feet of dry coal gas (measured at 15° C. and 760 mm.) can be calculated at any temperature θ in the range 0° to 60° C. with very considerable accuracy by the formula:

$$\log. W = 14{\cdot}2739 - \frac{3812{\cdot}34}{\theta} - 0{\cdot}02593 \log. \theta.$$

The following method of interpolation by logarithms is sufficiently exact for all practical purposes: The curve giving the relation of W to θ is approximately hyperbolic; so that log. W plotted against θ gives a curve of slight curvature which may, over small intervals, be regarded as a straight line. Log. W may therefore be interpolated by the method of proportional parts—*e.g.*, to find value of W at 12° C. we have:

Temperature.		W.		Log. W.
10° C.	..	5·49	..	0·7396
15°	..	9·39	..	0·9727

Difference of logarithms for 5° C. = 0·2331

∴ difference for 2° C. = 0·0932

$\therefore \log. (W)_{12°} = 0{\cdot}7396 + 0{\cdot}0932 = 0{\cdot}8328$

$\therefore W_{12} = 6{\cdot}8$ grains.

From Curve B, the value 6·8 grains is obtained.

SUMMARY.

(1) The vapour pressure of naphthalene in coal gas and air is determined at various temperatures between 0° and 60° C.

(2) The results are throughout in substantial agreement with the previous observations of E. Schlumberger, but differ at temperatures below 30° C. from the results obtained by R. W. Allen.

(3) An empirical formula of the Kirchhoff-Rankine-Dupré type is found to represent the experimental results very exactly.

THE FRENCH ARRANGEMENTS FOR THE EXTRACTION OF TOLUOL.

A Bill was recently introduced into the French Chamber to provide for the extraction of toluol from coal gas throughout the country; and the following statement was made by the Minister responsible for the drafting of the measure.

Gentlemen,—In time of war, the provision of explosives for each of the belligerent Powers is one of the first steps to victory. Hence the importance of the production of explosives is in the case of every nation linked-up with that nation's resources of raw materials which can be used for this manufacture, and which raw materials only exist in limited quantities. Among these raw materials one of the chief is the industrial product known by the name of benzol, which is composed by the mixture of various atoms of hydrogen, called by the chemical name of aromatic hydrocarbons. Among those which exist in benzol are notably the benzene, which serves, after various successive changes, for the preparation of melinite (picric acid).

The benzol is a product of the distillation of coal which is usually obtained by extraction from the gas which is driven off in coke-ovens; the gas being caught and treated in special apparatus. The ovens which admit of this treatment are known as recovery plants, and only exist in the more modern works. The number of these ovens which are actually working in France, or could be brought into operation during the war, is comparatively small. This source of raw materials is now being used to its very fullest capacity. Aromatic hydrocarbons are to be found equally in certain petroleum products, from which they can only be separated by more complicated methods. But these methods have nevertheless been adopted in this direction, and everything has been done which can be done.

There remains a third source of benzol, which is illuminating gas distributed in towns for heating and lighting purposes. These hydrocarbons are found in the proportion of some 20 grammes per cubic metre, corresponding to about 6 kilogrammes per ton of coal treated. It appears from various reports that Germany has already taken the necessary steps for the treatment of illuminating gas in the principal cities. Certain of our Allies are also doing the same. It is necessary to-day for France to take similar steps; and it is impossible to disregard the large quantity of explosives which she can obtain by using the raw materials thus collected. It seems, however, necessary to have recourse to legislation in order to adopt this process.

It must be noted that the extraction of benzol from the gas will have the effect of depriving the latter of a great part of its illuminating power, though its calorific value will be little reduced (from 1 to 5 per cent.). Gas will, therefore, only be able to be used for lighting purposes by means of incandescent mantles; but as these mantles have been almost universally adopted already, the proposal will, in fact, involve no serious inconvenience to gas users as a whole. The result will be, however, that the gas deprived of its benzol will not have the same qualities as before, and will not comply as a general rule with the terms specified in the contracts entered into between gas users and gas producers. These latter will therefore find it impossible to comply with their obligations; and so the State must relieve them of liability under this head.

In theory, it would no doubt be possible, at any rate in part, to restore its calorific and lighting value to debenzolized gas, by replacing the benzol by mixtures of hydrocarbons obtained by treating petroleum products in a certain manner. This solution does not appear to be applicable to France, where there are no plants sufficiently elaborate to permit of the preparation and distribution of the comparatively great quantities of special spirit which it would be necessary to mix with the debenzolized gas every day to restore its illuminating value. The only way of arriving at a practical statement appears to be the commandeering by the State for military purposes of certain products indispensable for war purposes, and thus to break all contracts relating to the commandeered products. But it will be necessary to indemnify the individuals affected, to the extent of the damage which may be caused to them by this commandeering.

As the Ministry of War has the right of commandeering, it would not have been necessary to obtain legislative sanction had not the question been one of great complication. On the one hand, it does not appear possible to requisition the benzols in the gas without commandeering the gas itself; and such a wholesale requisition, by destroying the existing contracts between municipalities and gas producers, would have far-reaching effects, which would raise all sorts of peculiarly delicate questions, and would involve certain difficulties and possibly regretable delays. Recourse to legislation obviates these difficulties. On the other hand, if legislative sanction is given to the proposed process, this process can be carried out more easily, and will appear more quickly as a step taken solely with the object of meeting the urgent requirements of national defence, and as an expression of the national wishes. By this means, it is possible to proceed very simply. It is sufficient to authorize gas producers to depart from certain clauses in their Statutes; but, of course, solely for the benefit of the State, and solely to meet military requirements.

In addition to the fact that present circumstances are exceptional, and of a kind which justify a departure from existing rights, the proposed solution only involves a negligible amount of damage to consumers. Owing to illuminating by means of incandescent mantles, the lighting properties of gas itself have lost their importance; and it is only its calorific value which is used. In addition, the expense involved by changing an ordinary burner from a flat-flame to a burner with a mantle is quickly recouped by the saving in the consumption of gas; so that it rests with the consumer to avoid being damaged by the great loss in illuminating power. In this respect, therefore, there is no reason for an indemnity. As far as the reduction in the calorific value of gas used not for lighting but for fuel is concerned, as this reduction involves the consumption of a greater quantity of gas to attain the same amount of heat, this, as a matter of strict right, should be indemnified by a reduction in the price of the gas proportionate to the reduction in calorific value. In fact, as far as each consumer is concerned, the sums involved are extremely small.

If the matter is looked at from an equitable point of view, and by comparison with the burdens imposed on the great majority of citizens by a state of war, one is forced to the conclusion that an indemnity is not justified, as it merely involves granting an indemnity to users of gas owing to the present position of their country. Remember, the price of coal, for example, owing to the war, is more than double. But the price of gas, except in a very few places, has not changed, or has only been raised to a slight extent; and the increase of expense (1 to 5 per cent.) which the proposed law involves for consumers of gas who will be affected, will still leave them in a more favourable position than that of their fellow-citizens who have not already this means of heating available. The arrangements proposed appear, therefore, to be the means best suited in the circumstances to give all manufacturers of explosives new supplies of raw materials which are indispensable at the present time.

Chains and Other Lifting Appliances.

A useful memorandum has been prepared for the Home Office (for official use) by Mr. G. Stevenson Taylor, H.M. Inspector of Factories, on chains and other lifting appliances. It deals with the causes of, and possible means of preventing, accidents arising from the fracture or failure of chains and such metal appliances as rings, hooks, shackles, swivels, &c., used for lifting purposes. Accidents caused by the failure of structural parts of hoists, teagles, and cranes are, it is pointed out, not uncommon; and the prevention of hoist and teagle accidents was dealt with in a report issued some years ago. The memorandum opens with a sketch of existing legislation relating to chains, &c.; and then there is an explanation of different types of appliances alluded to, and the methods of manufacture. A description follows of the kinds and proportions of links, rings, hooks, shackles, eyebolts, and swivels, and the use and wear of chains, slings, and other lifting appliances. The methods of testing, annealing, and examination are set forth clearly and concisely; and reference is made to the procedure of marking and keeping records of lifting gear. Failures of chains due solely to reduction of material by wear are, it is said, uncommon; but a moderate amount of wear reduces the strength of the appliance, and may be a contributory cause of failure. A number of failures of chains, rings, and other welded parts are caused by defective welds, which are due to scale and dirt between the joining surfaces of the weld, welding at a low temperature, or overheating causing burnt and brittle metal. Loss of life, serious personal injury, and damage to machinery and plant have often occurred through defective welds. Unfortunately, it seems that so far no positive method of detecting such welds has been discovered; and the chain user must therefore rely solely upon the careful observation and experience of the chain examiner. This being so, the fact is impressed upon the user that he should encourage frequent and careful examination of all lifting appliances, especially those with welded parts. In connection with another common cause of failure—namely, overloading—a point is mentioned which should be borne in mind. There are many American lifting appliances—such as patent blocks—used in this country. These are often marked with the lifting capacity in U.S. tons of 2000 lbs., and so are overloaded if worked to their full lifting capacity in English tons of 2240 lbs. The amount of useful information contained in the memorandum is in no wise represented by its cost, which is only 6d.

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Illuminating Engineering Society.—A meeting will take place at the Society of Arts Rooms on Tuesday, the 11th prox., when a discussion on "Some Principles in Industrial Lighting, with Special Reference to the First Report of the Home Office Departmental Committee on Lighting in Factories and Workshops" will be opened by Mr. J. S. Dow.

Underground Waters in Australia.—Dealing with this subject in one of the recent numbers of the "Scientific Australian," Mr. T. Parker directs attention to the diminished flow of water in many of the artesian wells of New South Wales, Queensland, and South Australia. An inter-state conference which considered the matter heard a good deal of conflicting evidence, but came to the conclusion that the decrease was mainly due to a reduction in the supply of underground water. The opinion is, however, held that it may be due to corrosion causing defective casings in the wells, and by shocks causing breakages and leakage. Mr. Parker advocates a new investigation and a survey of the wells; and he hints that several States will shortly undertake this.

SOME REFLECTIONS ON UNACCOUNTED-FOR GAS.

In a recent issue of "Het Gas," a correspondent writes, Heer G. J. Somer, who is the Manager of a Dutch gas-works, introduced the question of unaccounted-for gas. In Holland, this is a well-known topic; for almost all Dutch gas-works are municipally owned, and so all accounts and reports are considered and passed by the council. It frequently occurs, therefore, that in some town a councillor takes a remarkable interest in the figure of unaccounted-for gas. In one case mentioned by the author, the gas manager was blamed by a councillor for having a loss of 3½ per cent.

The point here is not whether 3½ per cent. is a big figure, but whether there is some connection between the gas production and the unaccounted-for figure. Correctly speaking, there can be no trace of connection between production and loss; but certainly there is the possibility of connection between the measurement of the produced gas and of the gas sold through the meters of private dwellings. One of the "golden rules," to keep the retorts hot, still applies; for with hot retorts there is a good make of gas. But when working with high temperatures, it is quite possible that the cooling is not sufficient to allow of condensation to really normal temperatures; and when the gas-works equipment is of moderate capacity, and the station-meter is placed in a somewhat enclosed space, it goes without saying that the gas produced is measured at a temperature slightly above normal. On the other hand, the delivered gas is distributed through mains in the ground; and for the temperature of the soil one may take an average 4° or 5° C. below normal.

In this way, a difference is arrived at in the temperatures of measurement of 5° or 6° C. in favour of the distributed gas; and as the gaseous contraction for every degree Celsius is $\frac{1}{273}$, it may be calculated that this small difference in temperature results in the fact that consumers' meters register 2 per cent. slower than station-meters. So that 2 per cent. of unaccounted-for gas is due to the difference in temperatures of the two measurements. To provide against this, a correction for temperature would be necessary; but in practical work this is impossible. It is, however, of interest to know that in a perfectly sound distribution system these losses may occur.

But there are also other factors influencing the question. Take, for instance, public lighting. How is the consumption of the street-lamps arrived at in various towns? Have they special meters for this department? Not at all. Looking at the available statistics, it is seen that in one town a figure of 100 litres hourly consumption per lamp is put down; in others it is taken as being 180 litres. Assuming a street-lamp burns 2000 hours a year, and that a town has some 200 lamps, this makes a difference of 1,120,000 cubic feet per annum. Street lighting, too, may have other effects on the figure of unaccounted-for gas, now that automatic lighting is extending in use. For distance lighting of street-lamps, it is necessary that every burner should have a pilot-light. Generally, it is taken for granted that these pilot-lights use only a trifling quantity of gas; and so the gas is not reckoned for. But is it really the case that the consumption of these pilot jets is only trifling?

The author works out the figures for his district, where there are about 150 street-lamps, put down at 120 litres per hour, without regard to the pilot-lights. The burning-time of the lamps is 1750 hours per annum. Taking the hourly consumption of the pilot-jets, as tested, at 10 litres an hour, they consumed 350,000 cubic feet of gas per annum, not paid for, as compared with 1,050,000 cubic feet for the paid-for consumption on the public lighting.

Therefore anyone having distance lighting for his public lamps, does well to bear in mind, not only the paid-for consumption, but also the consumption of the pilots which is not paid for. If this is not done, the pilot consumption is added to the amount of gas lost, thereby making this figure much bigger than it ought to be.

RECOVERING AMMONIA FROM WASTE LIQUOR.

The December issue of the "Journal of Industrial and Engineering Chemistry," contains an article by Mr. E. L. Knoedler, of the Welsbach Company, of Gloucester, N.J., U.S.A., regarding a recent investigation he made of waste products from the Company's plant, which brought to light a solution containing about 1 per cent. of ammonia, which was being discharged into the sewers.

The investigation showed that the solution consisted of a mixture of three ammoniacal solutions containing, respectively, the following percentages of free and combined ammonia:

No.	Per Cent. Free NH_3.	Per Cent. Combined NH_3.
1	3·5	0·170
2	0·5	0·025
3	0·1	0·005

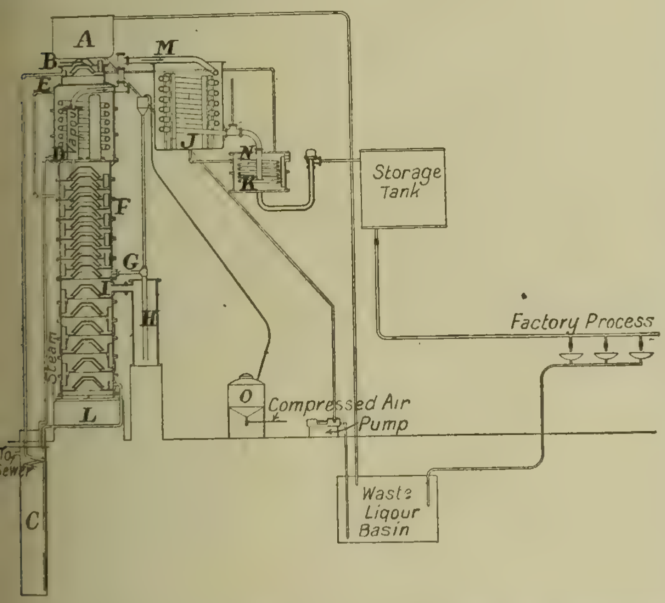
When mixed together, as they appeared when run to waste, the mixture approximated 1 per cent. of free ammonia and 0·05 per cent. of combined ammonia. The solution was perfectly clear, and recovery of the ammonia was found to be practicable by the usual methods of distillation.

The waste liquor was produced by the factory processes at ractically a constant rate throughout the working day; and this onsideration influenced the decision to recover by means of a ontinuous still. In the selection and erection of the apparatus, ie points of easy and inexpensive maintenance and operation ere carefully considered, with special attention to low labour narges and small steam consumption.

With these points in mind the distilling outfit was so erected and et that the waste liquor flowed by gravity from the factory proesses to a large iron tank set in the ground just outside the stillouse, from which it is pumped to the storage tank set above the olumn of the still. This pumping is the only handling of any quor during the complete cycle of operations—the storage tank ipplying the liquid at a constant head at all times, whence it ows by gravity through the washer, the coils of the heat exnanger, the heater, and the still—the waste passing around the oils of the heat exchanger and then to the sewer. The ammonia apours pass through the condenser and into the absorber, from hich the freshly-distilled ammonia overflows into the storage ank, which is set at such a height that the fresh solution flows y gravity to the factory, where it is available for use by simply pening a cock.

The steam supply for the still is automatically controlled, as is lso the delivery of lime for the release of the fixed ammonia, so nat it is necessary for the attendant to look in only once each our or two in order to see that the still is operating satisfactorily. he bulk of the heat in the waste liquor is saved by preheating he crude liquor in a heat-exchanger and seal-pot—the latter cting also as a constant-flow automatic valve for the release of he waste. The consumption of lime is reduced to a minimum y keeping the milk of lime constantly and thoroughly stirred, nd delivering it in small quantities, and at frequent and regular ntervals.

By these provisions for automatic operation, the cost of attenlance and the handling of liquor, lime, &c., have been reduced to minimum; the only still charges of any consequence being inerest and depreciation, and coal for steam.



The operation of the still is extremely simple. The weak liquor is pumped to the storage tank A by means of a small steam-pump, the exhaust of which is led into the still to decrease the steam consumption. The liquor then flows by gravity at a constant rate, down through the washer B, and then through the coils of the heat-exchanger C, back up through the heater D, where it overflows through the pipe E into the volatile still F, where the free ammonia is driven off. The liquor then passes out through the pipe G into the lime-leg H, where it meets, and is thoroughly mixed with, the milk of lime, when it passes back into the still for fixed ammonia I. Here the fixed ammonia is released, and the waste liquor passes down and out around the coils of the heat-exchanger by the pipe L, and overflows to the sewer.

The ammonia vapour passes up through the still, bubbling through the down-coming liquors in its passage from one section to the next, and then passes out through the coils in the heater D and over into the condenser J by the lead pipe M. Here the water vapours are condensed; and a part of the ammonia is absorbed. The condensate then flows down into the absorber K, where it is kept cool by means of water flowing through the coil N. Here the balance of the ammonia vapours are absorbed; and the resulting ammonia solution passes over into the storage tank, from which it flows by gravity through lead pipes to the factory where it is used.

The milk of lime is made up and kept in an iron stirring tank O, where it is agitated continuously by means of compressed air, which also operates the automatic valve, through which the lime is delivered to the still. The timing of this valve is regulated by a needle-valve and bye-pass between the top and bottom of a cylinder filled with kerosene, in which a piston descends and ascends. This makes it possible to supply the lime in small quantities and at frequent and regular intervals—making for uniform temperatures and regular operation.

Steam is supplied to the still through an automatic valve also operated by compressed air; the controller consisting of a thermostat, depending for its operation on the expansion or contraction of a liquid. The pressure thus generated serves to operate a small air-valve, which, in turn, controls the compressed-air supply to a diaphragm valve through which steam is served to the still. The thermostat is adjusted to operate at the temperature of the top of the still, and serves to keep this temperature within a range of 2° Fahr. of the predetermined point. The concentrate runs about 28 per cent. NH_3 at all times, and is diluted to the desired degree as used.

The cost of operation per ten-hour day runs approximately as follows:

Steam, 12,000 lbs.	$3.00
Labour and supervision	1.23
Lime	0.20
Repairs, paint, oil, waste, &c.	0.35
Interest and depreciation	1.93
	$6.71
Output, 3000 lbs. of 26 per cent., NH_4OH	
Cost per 1000 lbs. of 26 per cent. NH_4OH	$2.24

The outfit has proved to be simple in construction and easy to operate, and the results more than come up to expectations.

POWER PLANT IN FACTORIES.

Before a well-attended meeting of the Junior Institution of Engineers, on Monday evening of last week, Mr. W. A. Tookey (the Chairman) read a lengthy paper on the subject of the "Modernization of Power Plant in Factories."

As justifying his choice of this subject, he remarked that in the more or less immediate future there will undoubtedly be much work for the engineering profession arising from the establishment of new industries in the country, and also from the modernization of factories that have been in existence since a generation or so ago. He did not devote attention to matters pertaining to the planning or equipment of new factories, but to some of the more important details that have to be considered and determined in connection with the modernization of existing concerns. As he remarked, in a new undertaking the co-ordination of power generation and transmission, and of heating, lighting, and ventilating systems may be comprehensively studied; and at the same time each separate requirement can be considered, and such a decision be come to as shall ensure the highest all-round efficiency being eventually secured. In the conversion of existing systems in factories already established and in operation, on the other hand, not only do the same matters have to be considered just as fully, but due regard must also be given to the relative importance of various conflicting issues. Speaking generally, he said that it must be admitted that in many factories throughout the country a large amount of wastage goes on from day to day, which prevents the old-established concerns from competing effectively in the open market with the undertakings that have been started in recent years in Great Britain, Germany, or the United States. The wastage which goes on in factories that cannot be classified as modern does not necessarily imply either lack of knowledge of what other people are doing in the same industry or lack of any spirit of progressiveness. Mainly it is the result of undue caution in the spending of capital. Much of the inefficiency that can be noted in old-established factories can be attributed to the purchase of unsuitable apparatus, as a result of parsimony induced by the desire of proprietors to limit to a minimum their outlay on tools and appliances.

Gas for Power.

Considering what would be the best form of power plant to instal for all-round results, in connection with particular trades, Mr. Tookey first referred to what would be the ideal conditions from the point of view of maximum efficiency. These, he said, would include continuous working over long periods, as also the utilization of various products resulting from coal carbonization, which are entirely destroyed in the usual practice of steam and gas generation. This, however, implies that the plant shall be of such capacity that the cost of recovery of otherwise waste products would be commercially worth doing. It also involves a reasonably high load factor, and the distribution of power so produced either in the form of gas or electricity, and thereby further assumes that the plant will be placed in such a locality as will allow of transmission being efficiently provided for, and the entire output be sold at remunerative prices.

While admitting that such conditions as these cannot be universally met with, he pointed out that in some cases the ideal has been closely approached. Gas undertakings extract the utmost value of the residuals in the carbonization of coal; and, said Mr. Tookey, "every day sees progress being made in the many problems that are presented to the engineers specially engaged in this branch of engineering science. It is unfortunate, however, that, despite all that has yet been done, the price at which the gas thus manufactured can be distributed is such that, speaking generally, only for comparatively low-power engines is its use commercially profitable." Other instances cited were the distribution in South Staffordshire of low grade power gas suitable for engines and for furnace work, a central gas-power electricity works in the

North, the installation of bye-product coking-ovens, and the utilization of blast-furnace gases.

The author went on to remark that the competition which exists between gas and electric undertakings for the supply of motive power for factories in large towns is particularly keen; and it is therefore important to realize the relative costs upon a truly comparable basis. In the case of an electric motor, there are several outstanding advantages, when compared with a gas-engine; but usually the cheaper operating cost of the latter makes it preferable for purely commercial reasons. Considering in detail the working costs, the author, referring first to gas-engines, dealt with the question of compression pressure, the falling off of thermal efficiency with reduction of this pressure, and the loss due to friction. Summing up the calculations, he said the following figures would give a good idea of the actual efficiencies reached by a gas-engine at various loads, and would indicate the gas consumption thereby entailed on the basis of cubic feet per brake horse power, assuming that the gas had a calorific value of 500 B.Th.U. per cubic foot.

—	Compression Pressure, Pounds per Sq. Inch.				
	50	80	100	120	160
FULL LOAD.					
Mechanical efficiency . . .	·81	·84	·85	·86	·864
Cubic feet per B.H.P. hour (500 B.Th.U. gas.) .	31·5	21·7	19·3	17·65	16·45
THREE QUARTER LOAD.					
Mechanical efficiency . . .	·76	·80	·81	·82	·83
Cubic feet per B.H.P. hour .	33·5	22·7	20·2	18 5	17·1
HALF LOAD.					
Mechanical efficiency . . .	·675	·73	·74	·75	·76
Cubic feet per B.H.P. hour .	37·5	24·9	22·2	19·75	18·7
QUARTER LOAD.					
Mechanical efficiency . . .	·51	·58	·60	·61	·62
Cubic feet per B.H.P. hour .	50·0	31·5	27·3	25·0	22·9

Probably, Mr. Tookey added, the majority of gas-engines may be considered as working at a mean load equivalent to five-eighths of the maximum; and the table shows that, according to the age of the engine, as indicated by the variation in compression pressure, the gas consumption will vary from about 35 to 18 cubic feet per B.H.P. hour. Assuming that a compression pressure of 120 lbs. applies to the larger number of engines that are at present in operation, then, for comparable figures with regard to electric motors, it might be taken that the average engine demands (say) 19 cubic feet of 500 B.Th.U. gas per B.H.P. hour. Thus if the average price of town gas to power consumers be taken as 1s. 8d. per 1000 cubic feet, generating 1 B.H.P. hour would cost 0·38d.

ELECTRIC MOTORS.

As regards electric motors, continued the author, the estimation of the rate of current consumption is a much simpler matter. The efficiency varies according to the size; being higher in large machines than in small. While the larger machines will give out as power 90 per cent. of the current applied to the terminals at full load, 88 per cent. at three-quarter, 84·5 per cent. at half, and 74 per cent. at quarter load, smaller ones will yield (say) 85 per cent. at full load, 84 per cent. at three-quarter, 79 per cent. at half, and 70 per cent. at quarter load. Adopting the mean of these figures, the following table shows the approximate current consumption of average motors at various outputs per B.H.P. hour.

	Full Load.	Three-Quarter Load.	Half Load.	Quarter Load.
Motor efficiency average . .	·875 ..	·86 ..	·82 ..	·72
Equivalent to units per B.H.P. hour	·852 ..	·868 ..	·91 ..	1·035

Assuming, said Mr. Tookey, as in the case of the gas-engine, that the normal factory load would approximate to the equivalent of five-eighths of the full-load output, it will be seen that somewhere about 0·89 unit would be consumed per B.H.P. hour; and therefore for similar working costs this should be procurable for the same price as 19 cubic feet of gas, or, upon the assumption of cost already made, gas at 1s. 8d. per 1000 cubic feet would be equivalent to electricity at 0·427d. per unit. In other words, electric current at 1d. per unit may be taken as equivalent to gas at 3s. 10d. per 1000 cubic feet. Having said this much, the author added that, notwithstanding this vast difference in favour of the small gas-engine served by town gas over small electric motors, there are many conditions under which the latter would preferably be installed; and these he enumerated. When, however (he proceeded), the load upon the engine or motor is fairly regular and continuous, it would be evident from the figures given that there is so great a difference in running costs that town-gas engines, in spite of the greater space required and the more constant attention needed to keep them in the best condition, offer very considerable advantages to small factory owners. In a pamphlet recently issued by the South Metropolitan Gas Company, with reference to installations of gas power replacing electric motors, this fact is deposed to by actual users; and Mr. Tookey declared that a number of these cases are personally known to him.

SUCTION-GAS PLANTS.

Some attention was given to the cost of operating suction-gas engines and producers, in regard to which it was said that, from a large number of plants of this type, operated under everyday working conditions, and including all wastage due to stand-by losses and utilizable portions of fuel supplied, it may be taken that about 2 lbs. of anthracite are required to generate the equivalent of an electric unit of energy. Referring only to fuel cost, and calculating on this basis, electricity at 1d. per unit would be equal to anthracite at 56s. per ton. Including other items, experience shows that the average cost of generating a unit of electricity by this means does not, with anthracite at 34s. per ton, fall far short of 0·75d., when overhead charges are also taken into account. In rough figures, therefore, while the cost of fuel is only about 0·375d. per unit, the other expenses usually amount to nearly as much again.

INSTALLATION COSTS.

A chart was included in the paper, showing comparative installation costs of town gas, suction gas, and electricity power plants; but it was pointed out that this could only be taken as a general guide, as so much depends upon local circumstances. However, the effect of the chart was to demonstrate that, for true comparisons, the interest upon the additional capital involved in the case of gas-engines should be set off in favour of the electric motor. It was shown, for instance, that, for 20 H.P., while a motor fixed would cost about £60, the outlay on a gas-engine of equal output would be nearly double, while a suction-gas engine and producer would cost nearly three-and-a-half times as much. Therefore the town-gas engine should be debited with £6 per annum as additional standing charges to cover higher depreciation and interest, and the suction plant with an additional £15. This, remarked the author, is tantamount to saying that much depends upon the average or mean load that will prevail during the period of work, and whether the amount likely to be saved by the more economical plant will, in fact, result in an actual saving of money, all things considered. Among the other important considerations to which careful attention must also be given, the amount of power required upon more or less rare cases of emergency must be taken into account; for, while the maximum power of a gas-engine is inelastic, an electric motor can deal with overloads for short or long periods without distress.

OTHER MATTERS.

In subsequent sections of the paper, power transmission was discussed, and reference was made to the cases in which for one reason or another steam would be desirable for power and other purposes. Some remarks followed on assessment for income-tax; the desirability being urged of making allowances from taxation in respect of money spent on factory improvements, &c., and of the abolition of the "three years' average" clause. As to depreciation allowances, it was said that, instead of these being based upon an arbitrary yearly percentage on estimated values, account should be taken of the amount of work actually performed by the tool or piece of apparatus. In conclusion, a table was given indicating the power absorbed by shafting in small factories.

Many of the points raised by Mr. Tookey were touched upon by the speakers in the discussion. Some of the members and visitors who contributed to this portion of the proceedings, expressed the opinion that the author, in spite of his long and intimate connection with the internal combustion engine, had shown no bias whatever in his paper; while, on the other hand, one, at least, declared that he perceived indications of a leaning to one side. That those present had spent a profitable evening, was evident from the cordiality with which they accorded Mr. Tookey a vote of thanks for his paper.

MEASURING A VENTURI TUBE DISCHARGE THROUGH A DIRECT-READING METER.

In the "Comptes Rendus," No. 16, Vol. CLXI., M. Dejust described the method he proposed for this purpose. It consists in replacing the usual apparatus for measuring, with an ordinary meter, the pressure difference between the full and the contracted sections of the tube and the integrating mechanism. The difference in pressure between the large and small sections of the tube causes a discharge between these two points. The intake of the meter is directly connected to the full up-stream section of the tube; and between the outlet and the down-stream contracted section of the tube a diaphragm is introduced.

The algebraic expression of the ratio of the discharge through the tube to that through the bye-pass containing the meter shows that this ratio is not constant. By adjusting the section of the bye-pass tube and its diaphragm, however, the terms which are not constant can be reduced to a negligible value, and the ratio made substantially constant for various rates of discharge. The constancy of this ratio has been tested on a line 100 mm. in diameter, provided with a Venturi tube having a contraction of 16 to 1, with a bye-pass 20 mm. in diameter, a meter orifice of 12 mm., and a diaphragm calculated to make the ratio of meter discharge to flow through the line, 1 to 100. By varying the velocity in the line from 0·16 metre to 1·23 metres, the ratio varied from 103·82 to 105·53—that is to say, 1·65 per cent. of the smaller number. Reckoning from the mean of these two values, 104·675, the maximum error will be 0·82 per cent. of the true discharge.

AR OILS OF VARIOUS GRADES IN RELATION TO THE PRODUCTION OF COMMERCIALLY IMPORTANT DYES.

In continuation of several recent papers in the "Journal des sines à Gaz," on the value of tar oils to the chemical industry, rofessor Mailhe, of Toulouse, in a further contribution to our ontemporary, passes in review the dyes of chief commercial nportance obtained from the various grades of tar oils. The ubject-matter of his paper is, of course, generally familiar to akers of synthetic colouring matters, although less a subject of veryday knowledge among distillers of coal. Hence the portion the paper which succinctly sets forth the character of the dyes hiefly obtained from light, medium, and heavy tar oils may be sefully translated as a supplement to the abstract of Professor ailhe's previous remarks published in the "JOURNAL" for the 4th inst. (p. 597).

Light oil—viz., that distilling at temperatures from 50° to 180° C. -while consisting chiefly of aromatic hydrocarbons, such as enzene, toluene, xylene, and cumene, contains also fatty hydroarbons (pentane, hexane, &c.), unsaturated hydrocarbons, such s hexene, and pyridine bases. The last-named are present in airly considerable quantity, and are recovered by treatment with ulphuric acid, followed by liberation of the base itself with mmonia. Their importance lies in the value of pyridine as a aterial for the purification of anthracene, since they yield nthracene of 82 per cent. purity, as compared with 50 per cent. y the use of other solvents.

By treating the light oils with sulphuric acid, unsaturated and asic compounds are removed, after which rectification with soda ields the various aromatic hydrocarbons, which are the starting oints for numerous colouring matters. The chief operations are e production of aniline by conversion of benzene into nitroenzene and reduction of the latter to aniline. In like manner, oluene yields a mixture of from 60 to 70 per cent. of ortho-nitro-oluene and from 30 to 40 per cent. of para-nitro-toluene, simiarly converted into ortho and para toluidine. These bases form he indispensable materials for the production of whole series of yes, one of the most important of which, from the industrial tandpoint, is that of the azo dyes, discovered in 1864 and posessing the several advantages of simplicity in manufacture, low ost of production, and great variety of shades. The formation f the colouring matters takes place in the cold; and practically ny substance having an amido (NH_2) group in its constitution an be used for the purpose of varying the series. Hence the normous number of azo dyes—to a total which must be reckoned n thousands. Certain of these azo dyes may be made so cheaply some are sold at 2 frs. per kilo) that many will long continue on he market.

Next, perhaps, in importance come the tri-phenyl-methane dyes—*e.g.*, fuchsine—obtained by the oxidation of a mixture of aniline and ortho and para toluidine. The series allows of colouring matters from red, through violet and green to blue, being readily prepared. The success of these dyes is still far from having reached its limit. By fusion of para-toluidine with sulphur, the thiazol series of dyes results, the most notable member of which is primuline.

The above large series represent dyes prepared from mononitro derivatives of benzene. The di-nitro compounds, reducible to phenylene diamines, are the starting points of still other series. Thus are formed the indamines, by oxidizing a mixture of paradiamine and aniline of the indophenols, in the preparation of which a phenol is mixed with the para-diamine. Similarly the thiazine dyes, including methylene blue, start from the diamines, as do also the euphrodines and saffranines. In all these and other series of dyes, aniline and toluidine play a predominant part. Germany in 1913 exported colours derived from aniline and its homologues amounting to nearly 64.300,000 kilos, representing a value of 180,000,000 frs.

Equally the medium tar oils, distilling at temperatures between 180° and 250° C., are found to possess great importance to the dye-maker from their content, first, of phenol and cresol bodies and, second, of naphthalene. Of these, the phenols and cresols occupy a quite secondary place; their value lying in their linkage with other compounds as in the making of azo dyes. The comparatively few colouring matters which have been introduced, prepared directly from phenol bodies, have not been of any practical value save for certain phthalein dyes. Rosalic acid, a purely phenol dye, is used in colouring paper.

On the other hand, naphthalene and its derivatives, forming the most abundant hydrocarbon of tar oils, by its chemical transformations gives rise to numerous and important series of dyes. Naphthalene is readily converted by strong or fuming sulphuric acid into mono, di- or tri- sulphonate, which acid compounds, on treatment with potash, are converted into naphthols or sulphonaphthols. These naphthols themselves are sulphonated with strong sulphuric acid, yielding acids which form the raw materials for the manufacture of the important Ponceau and Bordeaux colours.

The α napthol is used in the preparation of the only indophenol of which use is made on the industrial scale—namely, in admixture with indigo. Other dyes derived from naphthols by the action of nitric or nitrous acid, are Martius yellow, acid yellow, and gambine G and gambine R. Similarly, reduction of nitronaphthalenes yields naphthylamine bodies which, like aniline, give rise to important and varied series of azo dyes. Altogether naphthalene dyes, while not nearly equal in importance to those from aniline, nevertheless represented an export from Germany in the year 1913 amounting to 3000 tonnes, of the value of nearly 4,000,000 frs.

In the heavy oils, distilling from about 250° to 420° C., the hydrocarbon of importance to the dye maker is anthracene—the crude product containing about 30 per cent. of pure anthracene. By oxidation, anthracene yields anthraquinone, the starting point of the valuable alizarine dyes, which, though requiring a mordant, are yet widely used on account of the great resistance of the colours to soap and light, and the fine depth of the shades which they afford. Exact figures are not available; but it is known the quantity exported from Germany in the year 1913 was 5000 tonnes, representing a value of 15,000,000 frs.

In the above brief sketch, as Professor Mailhe points out, mention has been made only of dyes which are of the greatest industrial importance. It would have been possible to extend the list in many directions without going outside the wide field of colouring matters which are obtained from the raw materials in coal-tar oils. Professor Mailhe briefly refers to the hopes now being entertained in France of engaging in the commercial battle with Germany in supplying colouring matters. He recognizes, as the first step in this endeavour, the provision of preliminary organization for the purpose of producing practical chemists and directing them along lines which have too long been disregarded.

IMPORTANCE OF FLUES IN THE FIXING OF GAS-FIRES.

By H. H. Creasey.

[From the "Bulletin" of the British Commercial Gas Association.]

This article is intended as a note of warning to those outdoor representatives of gas undertakings who may not have had the opportunity of closely following the development of gas-heating stoves during (say) the past twenty years or so, and also to draw attention to the fact that builders, gas-fitters, and other workmen not connected with gas undertakings may be—and, indeed, in some cases are—fixing gas-fires in an unhygienic manner.

I do not claim to know all there is to know about gas heating and its past and future possibilities—indeed, who among us would be so rash as to make such a claim?—but having first been employed in fixing gas-fires twenty-five years ago by the undertaking which I still have the honour to serve, and having been specially engaged during the last eight years in endeavouring to assist in overcoming the far too prevalent and, in the past, all too well deserved prejudice against gas heating, I trust I shall not be considered as having rushed into print without some little knowledge of the subject under consideration.

Errors of the Old Gas-Fire.

Let us first briefly run over the development of the portable gas-fire, from the past "horror" to the present efficient, hygienic, and beautiful production, which is the result of knowledge and experience bought in that best of all schools, the school of adversity, coupled with many scientific experiments and the exhaustive tests to which all matters pertaining to gas-stoves are now subjected before the finished article is permitted to be presented to the public.

We will go no farther back than the old solid, or almost solid, lump ball-fuel fires, with balls of fire-clay indiscriminately pitched on to the bunsen flames, breaking their cones and causing imperfect combustion. These fires frequently had coloured tiles designed to match nothing on earth—except, it may be, a nightmare produced by a heavy supper—and as they were very deep, they always looked clumsy and stood too far forward on the hearth. In addition to these faults, the products of combustion were offered every inducement not to go up the chimney too rapidly, as the idea then prevalent was that valuable heat would thereby be lost. In order also to deliver as much heat into the room as possible, there were air-heating chambers in the upper parts of the fires, which chambers, as we all know, became dust-traps from which, when the fire was hot, a fine assortment of baked germs arose; and these, with convected heat at a harmfully high temperature, were delivered into the room.

The flue outlets of these fires were always circular, and, as a result, the products of combustion from a burner, covering a front of (say) 12 inches in width, had to crowd together above the top of the fire-clay balls in order to struggle through an opening only about 3 inches in width. Needless to say, they did not all struggle through. In addition to this, the fires sometimes contained devices such as flaps, which, when the customer could be induced to take the trouble to carry out this action, were to be opened or shut, in order to get rather less or more products than usual into the room; there were obstructions in the gas-fire canopies; the canopies were very small or almost non-existent; the flue-elbows were frequently made in grotesque shapes—usually, be it noted, being reduced to a smaller area at their outlets, in order that too much heat (or, in other words, products of combustion) should not be lost.

I know of a fire whose especially good (?) point was that the products of combustion, before being allowed to get away into the chimney, had to pass through a series of tortuous channels, whose existence was indicated to the customer by a printed design of the interior portion of the stove with arrows showing the way the products ought to go if they behaved themselves. Needless to say, the products usually lost their way, and, taking the line of least resistance, found themselves back in the room. All this in the endeavour to lose as little heat as possible!

Practically coincident with these fires there were those highly efficient metal fret fires, which, owing to the pursuit of the ideal of small heat losses, contained all the same faults as the ball fuel fires as regards the retardation of the products.

A New Era.

A stove, indeed one or two stoves, suddenly came on the market which were made shallower than usual, and of a better and plainer design. The fire-clay balls had disappeared, and their places were taken by a series of upright radiants, in order that the bunsen flames should not be broken. A bolder canopy and somewhat better flue outlet were also provided. I remember quite a number of experts questioning the loss of heat by such fires; and I also remember that I started fixing them in preference to any others because I knew they were on the right lines.

Improvements in Design and Flue Outlets.

Since then developments have come thick and fast; and we now have beautiful designs to suit all kinds of decorations and styles of furnishing—fires of absolutely plain design for those who prefer them, and, perhaps above all, fires which have bold canopies and wide oval flue outlets from which the products of combustion can pour out like water over a smooth waterfall, instead of, as in the past, being required to gurgle out like water from the constricted narrow neck of a bottle.

To come to my point, the stove manufacturers have now succeeded in constructing stoves that, unaided by flue-pipes, are capable of carrying off, or passing away from themselves, all the products of combustion of the greatest number of cubic feet of gas per hour which are ever likely to be consumed by them. To any that now remain doubtful of the hygienic efficiency of gas-fires, we are able therefore to offer scientific tests as proofs of our statements.

The Perfect Modern Gas-Fire.

The stove manufacturers can now claim that they have succeeded in producing what may be looked upon as practically the perfect gas-fire. I mean perfect from the point of view of hygienically giving out as radiant heat, and a very small amount of convected heat, the utmost efficiency that it is wise and expedient to extract from a gas-fire, making due allowance for the fact that a proportion of the total available heat must be used, not wasted, in assisting the ventilation of the room and effectively removing the products of combustion.

The Question of the Flue-Pipe.

Having carried out all the above-mentioned improvements, I am afraid the gas-stove manufacturers are somewhat encroaching on the preserves of us, the outdoor representatives, who have to fix the fires. By this I mean that there is a tendency on their part almost to recommend that their fires—because they are capable of dealing with, or passing from them, all the products of combustion—should be fixed without a flue-pipe. This is where they and I must part company.

I have no hesitation in saying that no gas-fire should be fixed to the average chimney without a short length of flue-pipe securely attached to it; and I have also no hesitation in saying that, owing to the tendency I have just mentioned, a number of gas-fires were fixed without flue-pipes last season. This probably more especially applies to work carried out by builders, gas-fitters, and other workmen not employed by gas undertakings; but the result will be no less harmful on this account.

Dealing with the Products of Combustion.

It is admitted that the modern gas-fire will do all that the manufacturers claim for it; but they do not seem to consider that what is of vital importance is where the fires deliver their products. Because a gas-fire is capable of passing away all its products of combustion unaided, should I be right in standing it in the centre of a room without a flue-pipe? Of course not. Therefore, the point is: Where are these products to be delivered in order that the fire shall be as hygienic in use as it is hygienic in construction? Unless the products are delivered into the chimney proper, I claim that a gas-fire that may be hygienic in construction is not hygienically fixed. As there are so many things that may hinder the products getting into the chimney proper, it is always advisable to fix a flue—say, at least 18 inches in length—to the gas-fire flue outlet in order to ensure that they do so without question or doubt.

The flue outlet of the average gas-fire, if stood back against the average modern coal-grate, will either discharge against the sloping back brick, or will partly discharge against the coal-grate canopy. The products in such cases are beaten back, especially if the rake or angle at which they leave the gas-fire is not quite true with the angle of the opening up which they are to pass. Even assuming they get easily past these possible obstructions, they may still be partially obstructed by the brick projection usually found above the coal-grate canopy, known as the breast or arch bar, or there may be the iron frame of a register to negotiate, and so on.

The result of all this is that the products are either beaten back before they have even had a chance to get away, and accordingly return through the gas-fire canopy—making this certainly not a ventilator, unless "ventilating" inwards is aimed at!—or else they do partly get away; but a proportion, instead of getting into the chimney proper, hang about in the canopy area, or at the back of the stove, and eventually find their way into the room, either from the sides of the gas-fire, the leaky sides of the coal-grate canopy, or the leaky top rib of the coal-grate canopy. I have fixed a good number of fires and have dealt with numerous difficult cases; and I am confident my statements are correct.

I will go further and say that if gas-fires are not fixed with short flues, leading the products direct into the chimney proper above the canopy area, we shall be taking a step backwards, and all the good work that has been done to popularize gas heating [because it can be made to be convenient as well as cleanly, and hygienic as well as economical] will have been wasted, and opportunities will be given for scientists, our customers, and our opponents to claim that gas-fires still smell and are not hygienic. The effect of this might not be immediately or directly noticeable; but the unfailing result would be a check to the recent triumphant march of gas heating, as many customers with a good sense of smell or hypersensitive nostrils would not have gas-fires fixed in their houses, and would spread the bad, instead of the good, word among other possible customers, who, if they used gas-fires at all, would do so to an extent that would be limited by the demands of necessity and not, as we wish, those of inclination and desire. Moreover, as we claim that gas-fires are ventilators—and justly so, if they are properly fixed—let us always make them so, and not be satisfied with fixing in such a manner as to just allow the products to struggle away up the chimney, or even perhaps not quite to do so.

Exceptional Cases.

I quite understand that all my remarks must be qualified in the case of excessive updraughts, when it may be possible to do without a flue at all, or it may be necessary to fix a reducing flue as a check, or in the case of a downdraught, when special measures must be taken according to the circumstances. They probably do not apply also in the case of built-in grates fixed to chimneys of average draught. They principally apply to the ordinary portable fire fixed to a chimney of average or sluggish draught, and especially when fixed to a modern slow-combustion grate, an old-fashioned metal grate with a rounded top, or a register grate, which register may get shut, or partly shut, or obstructed by brick rubbish after the gas-fire has been fixed.

I hope I shall be forgiven for writing so strongly on this point, because there are, of course, thousands of representatives who, like myself, could not be induced to make a practice of fixing gas-fires without flue-pipes; but in case any might be lulled into a sense of security by the perfection of the modern gas-fire, and thereby induced to abandon the general use of flue-pipes, or to condone such an offence when committed by others, I thought it in the best interests of the future of the gas industry to write this article, as damage might be done in the next few years that would probably take several years to put right. Let us beware of putting the clock back and falling into our old errors.

Gas for a Rust-Proofing Process.—In the process worked by the British Bontempi Rust-Proofing Company at Deptford, cast iron, wrought iron, and steel are oxidized by being placed in an air-tight muffle previously heated by gas-jets. Superheated steam is admitted into the muffle; and after about half-an-hour of this treatment, the steam is shut off, and a chemical substance in the form of a powder is placed in a separate retort also heated by gas. The fumes from the chemical powder then enter the muffle under pressure, and give the material being treated a protective coating of oxide. Dipping in oil while still hot, changes the light grey colour of the metal to a blue-black.

Illuminating Engineering Society.—Professor J. T. Morris delivered a lecture, to introduce a discussion, at the last meeting of the Society (at the Society of Arts rooms), on "Recent Developments in Electric Incandescent Lamps in Relation to Illuminating Engineering," in the course of which he traced the gradual development of intrinsic brilliancy of the source of light from the carbon lamps to the gas-filled or "half-watt," and hermetically enclosed tungsten arc. In the course of his remarks, he referred to the "enclosing area" of a light-giving source—*i.e.*, the area enclosed by a line passing round the outer boundary of the light-giving source—and pointed out that, as the field of the light-source is reduced in area, so greater opportunity offers for designing reflectors or shades to give any desired distribution of illumination. On the other hand, greater care is required in placing the reflector in its correct position with respect to the source of light. With this greater concentration of light comes the imperative need of screening or otherwise reducing the effect of the direct light falling upon the eye. These improvements, he said, call for even closer co-operation between lamp and shade manufacturers. Various forms of lamps were shown, including the hermetically sealed tungsten arc in operation. The source of light in this lamp is concentrated to such an extent that it can be used with excellent effect for projection purposes. Examples were also given of special arrangements of lighting.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Origin of the Sliding-Scale.

Sir,—It seems desirable, having regard to the many points that have been raised and suggestions of origination in this matter, that I should state (what I have a clear recollection of) the facts leading to the insertion in the Act of 1875 of the Commercial Gas Company of the sliding-scale clauses in the form in which, with more or less modification, the provisions are now known as sliding-scale clauses.

The provisions that existed before 1875 for the revision of prices of gas in the Acts of 1868 attaching to the supply of gas by the companies supplying the City of London, had led to one or two Courts of Inquiry by Commissioners, resulting in considerable additions to the price of gas charged within the scope of the legislation of 1868. But the addition to the price was so large, and caused so much discontent in the then Metropolitan Board of Works and City Corporation, that, on the motion of the public authorities, concurrently with the applications to Parliament of the then Gas Light and Coke Company and the Commercial Company (and the Bills of the public authorities), the Bills were sent to a strong Committee, with the late Mr. W. E. Forster, of educational renown, in the chair.

Anterior to this—either in a separate paper read by himself before the then British Association of Gas Managers, or in a discussion, Sir George Livesey had promulgated the view that legislation on the lines of giving an additional dividend upon reduction of price of gas, coupled with that which had never existed before—a forfeiture of part of the dividend, in the like proportion, on raising the price of gas—would furnish the best readjustment possible, and would do away with the discontent then broadly felt by the consumers of gas.

The then Mr. Farrar, of the Board of Trade, had noticed this, and had expressed his approval of the principle, which was afterwards conveyed to Mr. Forster's Committee in an official letter.

The Commercial Gas Company's Bill had been strongly petitioned against, and was actually opposed by the Gas Light and Coke Company, who raised the extraordinary claim that, as they had amalgamated or absorbed most of the companies round London, they should be allowed to absorb the Commercial Gas Company—rather than that the latter Company should be permitted to itself absorb the smaller Ratcliff Gas Company, and go on alone.

This opposition was so strong that the position was felt by the Commercial Company to be extremely difficult—especially as the Gas Light and Coke Company had attacked its administration—particularly in connection with its application of reserve fund moneys to the capital purpose of the purchase of land, &c.

The late Mr. Cripps, for whom it was claimed recently in the "Times" that he had introduced the sliding-scale legislation, was simply the Agent for the joint opposition of the Corporation of London and the Metropolitan Board of Works.

The late Sir George Livesey and myself had long been converted to the sliding-scale principle—no less because, in the Bill of the Watford Gas Company (dated as far back as 1871), I procured the insertion of a sliding-scale clause, which went only half-way to the present system by allowing extra dividends to be paid on reductions of the price of gas, but with no penalty on raising the price above the standard.

Between us, we converted my father, Mr. Robert Jones, then the Engineer of the Commercial Gas Company, to our view; and he procured a consultation with the late Mr. William Newton, of the Metropolitan Board of Works (then the representative of the Mile End district, in which the Commercial Gas Company's works were situated), whereat it was settled that the Commercial Company would be willing to agree with the Metropolitan Board of Works upon the sliding-scale principle. When the time came that Mr. Farrar's letter endorsing Sir George Livesey's view was read out by Mr. Forster to his Committee, the Counsel for the Commercial Company was authorized to agree to the acceptance of it, and the Agent of the Metropolitan Board of Works was able to give their approval.

This is the secret history of the adoption by the Commercial Gas Company of the new legislation. But the Gas Light and Coke Company declined absolutely to accept it; and their Bill was withdrawn, or thrown out, and their opposition to the Commercial Company's Bill necessarily failed.

There is not the slightest doubt that Mr. Hunt's statement is absolutely correct. The late Sir George Livesey was not only the originator of the double sliding-scale, but he actively promoted its acceptance and adoption by the Commercial Gas Company and the public authorities, and so raised a storm of feeling against himself personally. In giving evidence in support of the Commercial Company's Bill, he was violently assailed by the chief Counsel for the Companies, the late Sir Edmund Beckett Denison, afterwards Lord Grimthorpe. So strong was the feeling on the part of the gas companies, that the Commercial Company and your humble servant and his father were for a long time looked at askance.

If I remember aright, the Imperial Gas Company in 1876, as well as the Gas Light and Coke Company, point-blank refused the sliding-scale, which was made conditional; but ultimately the Gas Light and Coke Company swallowed the pill. The South Metropolitan Company, coming later, were very disappointed that the terms they could get were not those given to the other companies—viz., 3s. 9d., with standard dividends of 10 and 7 per cent. on old and new capitals respectively. Sir George Livesey complained, naturally and bitterly, that because they had always supplied cheaper than the rest of the Metropolitan companies, the difference was maintained against them in the standard price allowed.

It was not really for many years after this that the engineers of the Metropolitan companies were converted to the system. All sorts of evasions were suggested; and a sterilizing neutral zone was actually introduced in some cases, through the influence of distrustful fears.

The sliding-scales before this were one-sided. I had introduced an incremental scale in the Watford Gas Company's Act of 1871; but there was no counterbalancing forfeiture on increasing the price of gas. Something of the kind existed in one of the Acts of the West Ham Gas Company.

The enormous benefit in security and permanence of dividend arising from the system, cannot fail to have impressed itself on the companies, as throughout the kingdom it now prevails. Notably, in the present conjunction it saves the position with regard to coal purchases, because it is understood, and has been declared in parliamentary discussion by the President of the Board of Trade, that any relief of burden goes directly to the gas consumer by the operation of the sliding-scale. Without this answer, those companies who are now so effectively helping in the Munitions of War would find their embarrassments considerable.

I have not the time to look up further points in the parliamentary history of the progress of the sliding-scale; but if I should go further into records, and they are of interest, they shall be at your service.

Hy. E. Jones.

Palace Chambers, Westminster, S.W., Dec. 24, 1915.

Exports of Sulphate of Ammonia.

Sir,—On the 20th inst., the "Times" published an attack on the Board of Agriculture, making statements which implied that manufacturers of sulphate of ammonia were starving the home market in order to make profit in the export market.

As these assertions were entirely false—seeing that sulphate of ammonia manufacturers have accepted a heavy sacrifice in selling at £14 10s. for home use for November-December—we wrote to the Editor of the "Times," pointing out the facts. For reasons best known to that journal, they have declined to publish our letter.

We think it may interest you to see a copy, and accordingly enclose same herewith.

Sulphate of Ammonia Association,
D. Milne Watson, Chairman.

84, *Horseferry Road, S.W.,*
Dec. 23, 1915.

[Enclosure.]

Supply of Nitrogen.

To the Editor of the "Times."

Sir,—Our attention has been drawn to an article in your issue of the 20th inst., entitled, "Destination of Exports." We do not propose to go into all the points raised by your anonymous agricultural correspondent; but we cannot too emphatically say that, so far as sulphate of ammonia is concerned, only surplus production has been, and will be, exported.

Of the quantity reserved for British farmers at a low price to be applied as an autumn dressing, so far only 18 per cent. has been demanded; the balance is still being held in reserve. As regards the spring, we have arranged to reserve a large margin over and above normal requirements, and, in addition to this, a quantity sufficient to make up the total deficiency of nitrogen usually applied in the form of nitrate of soda, assuming that no further shipments of nitrate for agricultural use will be possible.

All British requirements in nitrogen are therefore being provided before a ton of sulphate of ammonia is exported.

Sulphate of Ammonia Association,
Dec. 21, 1915. (Signed) D. Milne Watson, Chairman.

[Reference to the article alluded to by Mr. Milne Watson, and the reply of Mr. F. D. Acland thereto in the "Times," will be found among the "Miscellaneous News," p. 717.—Ed. J.G.L.]

Concerning Naphthalene Troubles.

Sir,—Having suffered considerably in the past through the difficulties of gas supply due to naphthalene deposits, I can fully sympathize with those in charge of gas concerns now going through a similar disturbing experience—an experience made all the more serious because of the absolute necessity, in these competitive days, for the prevention of discomfort and annoyance caused to the consumer in respect of inadequate pressure or total failure of the gas service. This being so, I trust it may not be out of place to offer the following description of the practical working here, as of interest to your readers.

Curiously enough, as in past periods of trouble when naphthalene was prevalent in one town and not in another, so it is found (up to date at all events) that with the "C" process in action at the works here no seriously increased cause for complaint has been marked, while in other concerns the trouble is obviously acute.

The following comparative statement giving the records of stopped services due to the deposit of naphthalene will clearly show that this is borne out by results. The naphthalene present in the outgoing gas is also added.

1914.	Complaints Per Cent. of Consumers.	Naphthalene in Outgoing Gas. Grains per 100 Cubic Feet.	Complaints Per Cent. of Consumers.	Naphthalene in Outgoing Gas. Grains per 100 Cubic Feet.	1915.
Jan.	1·2	5·7	·5	6·3	Jan.
Feb.	·2	6·7	·4	5·7	Feb.
March	·4	4·25	·3	7·5	Mar.
April	·2	6·8	·1	7·2	April
May	·3	7·0	·1	6·0	May*
June	1·2	8·12	·6	6·0	June
July	1·8	8·43	·5	7·2	July
August	1·2	10·4	·6	7·4	August
Sept.	·6	8·3	·7	7·7	Sept.
Oct.	·8	8·2	·6	10·5	Oct.
Nov.	·8	8·0	1·09	8·0	Nov.
Dec.	1·01	7·5	·5	7·5	Dec. 23

* The "C" process was started in May last.

The description of coal used in 1914-15 was Durham, with 1 per cent. of Yorkshire gas coals. There is no water-gas plant installed.

As set forth and described in a few notes contained in my paper, "Gas Practice at Great Yarmouth," read before the Eastern Counties

Gas Managers' Association at Stamford in 1909, it has been for many years the rule to scrub the gas in a washer containing anthracene oil, as also to use on the outlet mains a "Simplex" vaporizer and enricher in which petroleum and carburine when necessary are employed in similar manner to that described by Mr. Price in a recent letter on this question, again to keep petroleum on the gasholder tank water—the latter idea having been found to reduce wet naphthalene deposits, which when occurring present the mischief in its very worst form and most difficult of removal.

Although the reduction of the naphthalene content in the outgoing gas, as shown, is not as low as obtains in many cases which have come under notice, yet it has not been found that any particular variation in the number of complaints has been recorded over that of the earlier days of experimenting here, when for long periods the recorded figures were 3 to 3½ grains per 100 cubic feet; and I am sure that many will bear me out as having had like experiences in this regard.

There is no doubt that the suggestion of vaporizing petroleum—no matter what plant is used—does very largely assist in the alleviation of the difficulty. But I must confess that it is nevertheless as well to have a force pump or two at hand. I cannot think, although it has been stated, that there is, under varying conditions of temperature, absolute freedom from naphthalene nuisance in the gas services.

I would like to add that our carbonizing is effected by machine charged, fairly well filled horizontal retorts working eight-hour charges, and would suggest that it would be most helpful (for comparison) if, when writing on this important subject, the descriptions of the coals used, the percentage of water gas sent out, as well as the systems of retorts (whether vertical, horizontal, or chambers) and the method of working are given.

Quite recently in working the "C" process here, it has been found an advantage to add a convenient quantity of anthracene oil to the tar flowing through the washer, and to allow the treated tar to overflow by way of a syphon pipe connected to the bottom of the vessel, instead of at the usual working level, in order to maintain the washing agent in a more uniformly liquid condition and to avoid the possibility of absorption by the gas of naphthalene contained in heavy tar accumulating through any cause whatever.

William T. Carpenter.

Great Yarmouth, Dec. 24, 1915.

Gas-Fires and Electric Radiators.

Sir,—May I reply to the comments in your issue of the 21st inst., relative to my recent lecture on electric radiators at the University College?

It is not quite clear why you should think that the remark on gas-fires was evidence of a desire "to say something to please an electrical audience." I am often accused of saying very unpalatable things to technical audiences, but not often of the opposite tendency.

It appears from the Technical Press that this reference to gas-fires has been misunderstood, although the MS. of the lecture seems to be perfectly clear. In drawing a distinction between the air temperature and what I have called the "radiant temperature," it was pointed out that there is a certain temperature below which the air of a room should not be allowed to fall if comfort is to be secured—that no degree of radiant intensity (even one which scorches any fabric exposed to it) would compensate for too low an air temperature. The remark about gas-fires was to the effect that manufacturers of these had devoted so much attention to the improvement of the "radiant efficiency" that the air of a room may be insufficiently warmed although the radiant temperature may be so high as to scorch the knees of a person sitting 4 feet away from it. There was nothing about the glowing fire-clay being too hot.

Taken by itself, the temperature of the radiant element is not the essential point of the problem. Also the word "efficiency" in connection with any heating apparatus has only a very circumscribed meaning. It would be equally true to say that the efficiency of an electric heater must be in all cases exactly 100 per cent. as that it is generally rather less than 20 per cent. A "gas-radiator," too, may be said to have an efficiency of 100 per cent. or to be generally not more than 15 per cent. The same gas-fire might be said with perfect truth to have perhaps either 75 or 50 or 25 or 11 per cent. or less, all according to what is meant by "efficiency"—if, indeed, this expression can properly be used in connection with heating.

Its use in a commercial connection is certainly quite out of place for comparing two different methods of heating. The user is only concerned with the question, "What will it cost per week to make this room feel comfortably warm whenever I want to use it, and what is the most convenient means?"

These questions are much more complex than the scientific "efficiency" of the heaters employed, or the surface temperatures of the radiant elements, which considerations are only a small fraction of the whole problem. The user cannot say how often, or how long, he is going to use the room; nor how long before he uses it he will light the stove. He does not know what are the conditions which make the room feel comfortably warm. For the matter of that, neither does the gas engineer, nor the electrical engineer, nor, I believe, does anybody else! It is the very difficult problem we have been attempting to solve in my laboratory for years, the nature of which I made an attempt to explain in the lecture on which you comment.

May I be permitted to say that this perennial and somewhat acrid controversy between the gas and the electrical interests in this and similar connections seems, to an outsider who is solely interested in the object to be attained, to be sometimes more entertaining than instructive or dignified. Statements are constantly made by partisans of both sides which are so untrue or inapposite as to show that their authors have no title to be heard on the matter at all.

Is it permissible to plead for a more general recognition of the real essentials of the problem—for more light and less "hot air?"

A. H. Barker.

University College, Gower Street, Dec. 24, 1915.

The Sanco Gas-Mantle Company has been registered at Somerset House, with a capital of £5000, in £1 shares. The offices are at Nos. 84 to 86, Chancery Lane, W.C.

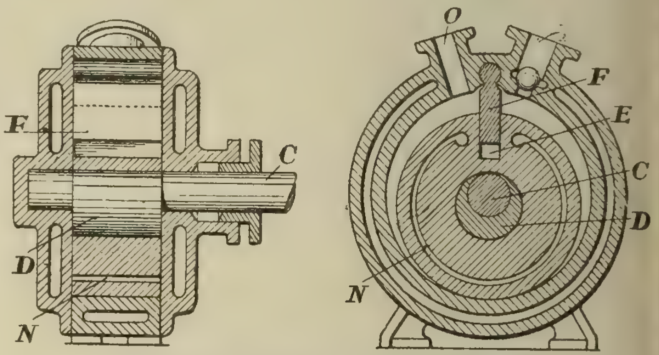
REGISTER OF PATENTS.

Rotary Blowers and Gas-Compressors.

Güttner, M., of Schmölln, Saxe-Altenburg, Germany.

No. 8003; May 29, 1915. Convention date, Dec. 19, 1914.

In rotary blowers and gas-compressors with a cylindrical piston eccentrically driven within a cylindrical casing, as described in patent No. 6896 of 1914, the cylindrical surface of the piston is mentioned as covered with a skin of elastic material in order to secure a tight fit between the surface and the cylindrical wall of the casing. This arrangement, it is said, offered the advantage of allowing each individual part of the piston surface to adapt itself most intimately to the part of the casing wall which it would come in passing contact with during each revolution of the piston shaft—thus rendering the tight fit between piston and casing still tighter in course of time. The arrangement according to the present invention is claimed to be an improvement—the elastic cover on the piston being replaced by a preferably ring-shaped slit intersecting the solid piston at such a distance below its outer surface that the part of the piston confined between the slit and the piston surface is rendered elastic.



Guttner's Rotary Blower and Gas-Compressor.

The preferred form of blower or compressor is shown in vertical longitudinal section and vertical cross section.

D is the eccentric block inserted between the shaft and the piston and movable within the latter. E is a rectangular radial longitudinal slot cut in the piston; and F is a tongue freely working therein in a radial direction and jointed to the casing wall by a cylinder joint. O is the gas inlet, and P is the outlet preferably provided with a ball-valve. A slit N in the piston extends all through it in a longitudinal direction and almost all around it; "so that its section has the appearance of a ring with a gap in it." The distance between the slit and the outer surface of the piston is such that the part of the piston enclosed between the slit and the piston surface is elastic to a certain extent.

The shaft C, in rotating with the block D fixed on it, causes the piston to execute a composite movement resulting from an oscillation around the pivot of the tongue F and a vertical oscillation along a straight line—this, it is claimed, being of importance in so far as the single parts of the circumference of the piston are thus continually brought in contact with the same parts of the casing wall, and the piston surface is thereby enabled to adapt itself in an always increasing degree to the inner surface of the casing.

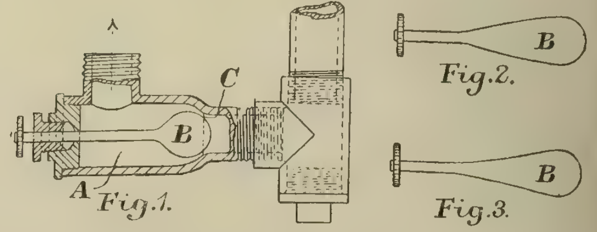
Controllers for Gas-Fires.

Grafton, W., of Glasgow.

No. 13,487; June 18, 1915.

This appliance is intended to control the supply of gas to gas-fires so that it will be noiseless during its passage to the injector.

The appliance (in the words of the patentee) consists of a regulating valve comprising a manually adjustable valve-head member having a substantially spherical seat-engaging face for co-operation with a correspondingly formed seat and having a stem behind the face ("behind" being considered in the direction of flow), and a valve chamber which is internally unobstructed and the passage into which is controlled by the member; the chamber being rounded internally in conformity with the valve member to present a valve seat, and so formed and dimensioned that the clear cross-sectional area of the passage for the gas increases progressively beyond the point where the gas passes between the valve-head and the seat. The valve-head is a partial obstacle to the fluid stream. The stream divides at some point in front of the obstacle, and passes around it in a series of well-defined lines that ultimately close together again at some point behind the



Grafton's Controller for Gas-Fires.

stacle. In some cases these stream-lines conform to the profile of obstacle itself for the greater part of its length; and when this ppens, the form of the obstacle within limits is such that it offers least possible resistance to motion in the fluid, and is of good eam-line form. The result of experimental research is that for a id such as gas to pass around an obstacle with the least resistance d friction, the tail end of the controlling member is fundamentally re important than the head; and therefore the blunt end or edge ould always be in front—*i.e.*, opposing the flow. Any sudden change curvature is to be avoided.

The invention is illustrated (p. 710) by a sectional view of one form, d two modifications of the controller head.

In communication with the gas-supply pipe is an internally unstructed valve chamber A in which is a manually adjustable valve B operating with an apertured valve-seat, the aperture C of which is of s area than the cross-sectional area of the valve chamber. It is derstood that the valve chamber is in communication with the intor member or members of the burners; the direction in which the s flows on its way to the burners being shown by the arrow.

The patentee draws particular attention to the formation of the valve controller head and of the valve-seat, "each of which is without y sharp edges." As shown, the design is to prevent sinuous motion ch as to ensure that the stream-lines are undisturbed even with comratively high velocity of the gas past the valve. To this end, the lve-head is formed with a spherical seat-engaging face which also sists the valve to be perfectly stable—*i.e.*, to have no tendency to avel out of the centre of the valve-seat. This spherical shape of the at-engaging face permits a uniform flow around the valve and allows gradual increase of velocity of the gas passing through the contracted ace between the valve and the seat and a subsequent gradual decrease velocity.

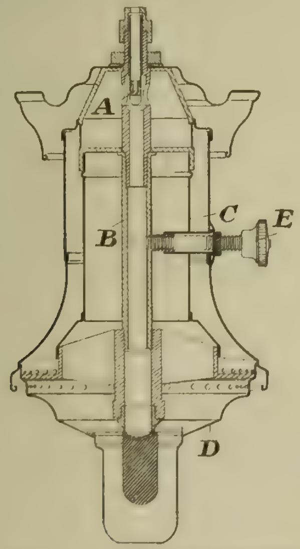
As shown in figs. 2 and 3, the controller head, in lieu of being nearly herical, may be of substantially "ichthyoidal" form.

Lamp for Gas under Pressure with Previously Heated Primary Air Supply.

Ehrich and Graetz, of Berlin.

No. 23,174; Nov. 27, 1914. Convention date, Dec. 2, 1913.

The illustration shows the invention claimed. The gas, under presre, issues from the nozzle A and flows into the mixing-tube B, at the me time drawing into it, by suction, the requisite supply of primary through orifices which communicate with the preliminary heating amber C. The mixing-tube terminates in a sleeve attached by ribs d an annular body to the lamp casing. The sleeve carries the burnerad. By a bayonet fastening, there is suspended, on the bottom part (arranged to form a reflector) of the lamp casing, a well glass or imney provided with a number of air-holes, preferably at the bottom. he primary air supply is regulated by a screw E.



Ehrich and Graetz's Gas-Lamp.

The patentees state that the lamp may be used without any outer lobe, even as an outdoor lamp.

Breaking-Down Clinker in Gas-Furnaces.

ILL, G. M., of Blackheath, Donald, D. B., of East Dulwich, and Jenkinson, W., of Stepney.

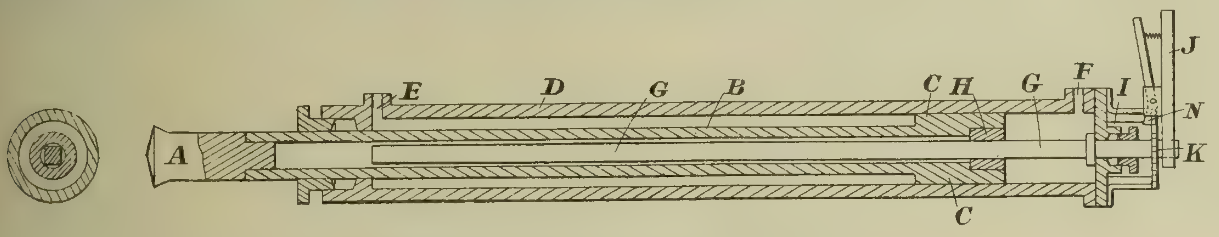
No. 24,426; Dec. 21, 1914.

This machine, for breaking-down clinker in furnaces, comprises a ol connected to a piston to which reciprocatory movement is imarted by fluid under pressure controlled by a hand-actuated valve and admitted to, and exhausted from, a cylinder supported on a portable carriage "in such manner as to be capable of participating in a universal movement." A machine of the kind is described in Gill's patent No. 23.862 of 1912. [See "Journal," Vol. CXXIII., p. 709.]

A longitudinal section is given through the working cylinder and piston of the declinkering machine proposed; also a cross section.

The tool A is of chisel-shape carried by a hollow piston rod B formed integral with, or secured to, the piston C, which is adapted to operate within the cylinder D under the action of pressure fluid admitted alternately to opposite ends by ports E F, and through the medium of a suitable valve and pipe connections. The piston rod is adapted to slide or reciprocate upon a rod G, which extends through an orifice in a bush H secured to the piston, and is mounted in a stuffing-box I provided at the rear end of the cylinder. At this point the rod is of circular formation in cross section, and extends through the gland of the stuffing-box so as to receive a hand lever J for turning the rod, together with the piston and piston rod, through any desired angle. Thus the rod forms a support or guide whereon the piston and its rod may reciprocate to ensure of the cutting edge of the tool, after adjustment, delivering successive blows at any predetermined angular position.

Adjacent to the lever J is a notched member K, secured by brackets to the rear end of the cylinder. Pivotally connected to the lever is a hand controlled catch device N, which is normally held in engagement with one of the notches in K by a spring. By disengaging the catch device from the notched member, the hand lever can be moved into any desired angular position—the tool A moving with the hand lever through the intervention of the rod G and the piston C, with which the latter engages through the bush H.



Gill, Donald, and Jenkinson's Clinker Removing Tool.

The cylinder D is mounted on a portable carriage [not shown] to permit universal or swivelling movement of the cylinder, and means are provided whereby the machine can be fixed securely in position when the cutting tool is in action. A carriage of this description is described in the 1912 patent already referred to.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Privately-Owned Railway Waggons.

Mr. Neville asked the President of the Board of Trade whether the Government were proposing to pool the railway waggons of the country; and, if so, whether, before deciding on the form such pooling arrangement would take, he would consult the representatives of waggon companies and private owners?

Mr. Runciman replied that it had been suggested by the Coal Mining Organization Committee and by the Port and Transit Executive Committee that railway waggons, including those belonging to private owners, should be pooled, and the suggestion was being carefully considered both by the Board of Trade and by the Railway Executive Committee. He recognized that there were great difficulties in the way of such a scheme. The interests of waggon companies and other private owners would, of course, be carefully considered, and representatives of those interests consulted before any decision could be come to.

Price and Quality of Gas.

Mr. W. Thorne asked the Minister of Munitions if he was aware that the loss in the illuminating and heating power of gas caused by benzol, toluol, and xylol being extracted could be made good by the use of oil and cannel coal; and if he will require gas undertakings where the test is abolished to use artificial substances to maintain the quality of gas or otherwise reduce the price to consumers.

Dr. Addison replied that consideration of cost and of difficulty in obtaining the materials required restrict the possibility of adopting the processes described, and—as the Minister of Munitions had previously explained—the deterioration in the quality of the gas supplied to consumers is hardly appreciable.

British Gas Undertakings in Germany.

Notice of the following questions has been given by Mr. King for next week: (1) To ask the President of the Board of Trade whether he is aware that at the opening of the war the gas undertaking of Frankfort-on-the-Main was in the hands of a British Company, and has now become the property of the Municipality; and whether this transfer, which was contemplated by a pre-war arrangement made by the Company, has had the attention and sanction of the Board of Trade. (2) Whether he is aware that several millions of British capital have been sunk in undertakings supplying coal gas to the public in various cities of Germany, Austria, Hungary, and Belgium; whether a register is being kept of undertakings of this and similar kinds in enemy countries; and whether, in any steps taken by the Government against enemy property, British interests abroad will be borne in mind.

LEGAL INTELLIGENCE.

United Gas-Works Development Company.

A petition presented by Messrs. Firth Blakeley, Sons, and Co., asking that the United Gas-Works Development Company might be wound-up under the supervision of the Court, came before Mr. Justice Neville last Tuesday. Mr. Willis, for the petitioners, said he understood the Company did not object to a supervision order; and Mr. Hilyard, for the Company, intimating that he did not oppose, his Lordship made the order as asked.

A Disputed Sulphate of Ammonia Contract.

In the King's Bench Division, before Mr. Justice Shearman, Messrs. S. F. Waters and Co. sued Messrs. Cochrane and Co. for an alleged breach of contract. Mr. G. Neilson, for the plaintiffs, stated that the contract was set out in the various letters and telegrams which had passed between the parties. The arrangement was that defendants should supply 50 tons of sulphate of ammonia per month for six months, from January to June, at a charge of £11 6s. 6d. per ton. The defence raised was that defendants had agreed to supply only 150 tons. By a mistake this was the amount specified in the contract; and also by an error plaintiffs' clerk wrote acknowledging receipt of the contract note as being all in order. The price of sulphate of ammonia had risen considerably since the contract was made. Mr. Raeburn, for the defence, contended that the plaintiffs were bound by their letter of acceptance of the contract note, which specified 150 tons. Mr. Alexander Crombie (manager to the defendants) stated that they had sufficient sulphate of ammonia to supply plaintiffs with 300 tons. The defendants considered that the contract was for only 150 tons; and the letter of acceptance confirmed this opinion. The 150 tons specified in the contract note was not a clerical error. His Lordship said there was evidently a mistake made by the plaintiffs as to the quantity which had been purchased, and by the defendants as to the total to be supplied. The amount was to be fixed in the contract note; and this was approved by the letter written by the plaintiffs. The plaintiffs had failed to make out their case; and he dismissed the action, with costs.

Claim by an Engineer of the Garden City.

In the King's Bench Division of the High Court of Justice, before Mr. Justice Darling and a Special Jury, Mr. Samuel Holt Donnelly sued the First Garden City, Limited, Letchworth, for remuneration which he alleged was due to him in connection with an improved water supply scheme whereby he enabled the Company to effect a saving of nearly £2000. Mr. Schiller, K.C., and Mr. Lincoln Reed appeared for the plaintiff; and the defendants were represented by Mr. Hawke, K.C., and Mr. Hunter Gray. Mr. Schiller said his client was a fully-qualified engineer of considerable inventive skill, and was the owner of several patents. Early in 1913, the defendants contemplated adding to their water supply plant by installing more pumps and a new rising main, in order that an extra supply of water might be pumped into the existing reservoir. The amount to be expended upon the new rising main was estimated by the defendants' Engineer (Mr. A. W. Bullmore) at £2000. It was hoped that by means of the new installation the supply would be increased to 40,000 gallons per hour. While the plans were under consideration, the plaintiff (who was in the Company's service) was struck with an idea. He recommended that the old rising main and the distributing main should be coupled, in order that both mains might be utilized in pumping the water into the reservoir. The result was that the Company were enabled to dispense with the projected new rising main. The expenditure involved in putting the plaintiff's idea into execution was only £160. When the question of remuneration was suggested, the Chief Engineer told Mr. Donnelly to leave the matter to him, and it would be all right. Inasmuch as he was in the employ of the Company, plaintiff relied upon the promise made; but after waiting for some considerable time, he did not receive the remuneration anticipated. It was true the Company had granted him a gratuity in connection with the work done in respect of the installation; but this was purely voluntary recognition of the zeal displayed by the staff. Plaintiff, in evidence, said he was claiming £900, or 50 per cent. of the actual saving by the use of his invention. Mr. Hawke, for the defence, contended that no evidence had been given in support of a suggestion that Mr. Bullmore had made a specific promise as to remuneration; and that, if such promise were, in fact, made, the Chief Engineer had no authority for making it. Mr. Bullmore stated that at no time did he make an agreement with Mr. Donnelly as to payment in respect of his invention. The distributing main had upon several occasions before Mr. Donnelly was engaged been used as both a rising and distributing main. The original sketch drawn by Mr. Donnelly was the result of instructions previously given by witness. The idea of coupling the mains, as represented, was a very old one. The Jury returned a verdict for the defendants, and judgment was given for them, with costs.

Loan Question at Stratford-on-Avon.—Some months ago, it was stated that the Local Government Board had refused to sanction a loan for further plant at the gas-works of the Stratford-on-Avon Corporation, and that the Council had come to an arrangement with Messrs. W. C. Holmes and Co. to carry out the work and charge a rental till it was possible to get a loan. The point then arose as to whether the previous carrying out of the work would prejudice the Corporation in their request for sanction to a loan; and as the result of correspondence, the Board have written stating that, in the special circumstances, the fact that the work had been proceeded with would not be regarded as in itself a sufficient reason for withholding sanction to a loan.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN COMPANY'S CAPITAL POWERS.

Various financial matters are dealt with in the Bill which, as already intimated in the pages of the "JOURNAL," the South Metropolitan Gas Company are promoting to authorize them to raise additional capital, and for other purposes.

It is felt by the Company that the provisions in their existing Acts with respect to the proportion to be maintained between the amount of money raised by the issue of ordinary stock on the one hand and the nominal amount of the debenture stock of the Company on the other hand, are in some respects, inconsistent, and their combined effect is not free from doubt. Therefore, with the object of defining clearly the obligations of the Company in these matters, and of making provision for future capital expenditure, they seek the repeal of unexercised powers of issuing capital and debenture stock, and authorization to raise from time to time additional capital not exceeding in the whole £1,000,000 (including premiums), by the creation and issue of ordinary or preference stock, with provisions for borrowing on mortgage and the creation of debenture stock.

Under their Act of 1901, the Company are empowered in the first instance to offer to gas consumers and persons in their employ any ordinary stock proposed to be issued; and as regards any unissued ordinary stock which they may decide not so to submit, or which having been so offered is not taken, are required, before offering it to the holders of any other stock of the Company, to submit such stock for sale by public auction or tender at a reserve price not less than the nominal amount thereof. Other provisions are also enacted as to the mode of disposal of any stock submitted for sale by public auction or tender and not sold. As in the prevailing circumstances the Company are unable to dispose of their ordinary stock otherwise than at a price less than the nominal amount thereof, and in certain other respects the conditions governing the issue of the ordinary stock of the Company are inconvenient and obsolete, it is proposed that ordinary or preference stock created after the passing of the present Bill, whether at a premium or not, may (with the approval of the Board of Trade) be offered to all the gas consumers and persons in the employ of the Company at as near as may be the average market price of such stock in the fourteen days immediately preceding such offer (provided that in no case shall the price at which the stock is offered be lower than 7½ per cent. below such market price). The average market price will be ascertained from the "London Stock Exchange Official List." Any stock so taken up shall, before being offered to the holders of any other stock of the Company, be submitted for sale by public auction or tender. Any stock which has been submitted for sale by auction or tender in accordance with the procedure laid down, but not then sold, may be offered, at the reserve price fixed for that sale, to the holders of ordinary, preference, or debenture stock. Any stock which has been offered for sale in one or more of the ways here set forth, and is not sold, may be again submitted for sale by public auction or by tender; and any such stock then remaining unsold may be otherwise disposed of "at such price and in such manner as the Directors may determine for the purpose of realizing the best price obtainable." These provisions will not apply to the issue of debenture stock.

Power is also sought to raise (*a*) by the issue of redeemable preference stock any portion of the capital which the Company are or may be authorized to raise as preference capital, (*b*) by the issue of redeemable debenture stock any money which the Company are or may be authorized to raise by the issue of debenture stock. Also to issue new ordinary or preference stock (the latter redeemable or otherwise) to such amount as may be necessary to provide money for the redemption or purchase of any redeemable preference stock, or new debenture stock (redeemable or otherwise) to provide for the redemption or purchase of any redeemable debenture stock; and from time to time to set apart out of revenue "such sums as they may consider necessary for the purpose of redeeming any redeemable preference stock or redeemable debenture stock which they may desire to redeem otherwise than by the issue of new ordinary or preference stock or new debenture stock under the powers of this section."

IMPERIAL CONTINENTAL GAS ASSOCIATION.

Provisions of their Parliamentary Bill.

In the Bill which the Association are promoting to remove doubts as to their power to sell or dispose of portions of their undertaking, and for other purposes, one of the clauses provides that the powers of the Association shall be deemed to include, and as from the passing of their original Act of 1870 to have included, power to purchase, take on lease, hire, hold, use, and manage, any undertaking for the supply to any cities, towns, places, or persons in any foreign country or in any British Colony or Dependency, of gas or any other light, or means of producing light, already known or hereafter to be discovered; to transact, undertake, or carry on, upon such terms and conditions as the Association may think fit, in conjunction with any other corporation, company, association, body, or person, any operation, business, or undertaking which they are authorized under their statutory powers themselves to transact, undertake, or carry on; to purchase or acquire and to hold, exercise, perform, operate, and enjoy any rights, contracts, concessions, or privileges of a like character with, or of a character similar to, or connected with, or incidental to, the objects of the Association, whether singly or in conjunction with any other corporation, company, association, body, or person; to acquire stock or shares in any body carrying on an undertaking of which the objects are similar to, or connected with, or incidental to, the objects of the undertaking of the Association; to sell, vary, exchange, let, lease, transfer, surrender, or otherwise deal with, or dispose of, any such undertaking has been mentioned, business rights, contracts, shares, or stocks ; l to establish, and provide funds for, in any place where the Associa- n are empowered to carry on business, any subsidiary company or npanies.

'urther, the distribution of funds made pursuant to resolutions sed at the ordinary meetings of the Association held in November, 4, and May last shall be deemed to have been lawfully made, and nave together constituted a dividend declared in November, 1914, l made and paid in respect of the period of six months ended ne 30, 1914. It is pointed out in this connection that, owing to the r, the Association have only recently been able to complete the re- ns from their various stations and to prepare the accounts relating he half year named, and are not yet in a position to make up accounts ating to any subsequent half year. At the meetings referred to, re- ntions were passed adopting the recommendation of the Directors t a distribution on account of the profits of the said half year iivalent on each occasion to 2½ per cent. on the capital stock of the sociation should be made from funds which constituted income, not- hstanding that it had been impossible previous to the meetings to pare a scheme showing the profits of the Association for the period rent since the preceding ordinary meeting at which a dividend was lared, and that the period in respect of which the resolution was sed at the meeting in May last was not, or might be deemed not have been, the period current since the preceding ordinary meeting which a dividend was declared. Distributions were therefore made iivalent in the aggregate to 4½ per cent. ; and it has since been ertained that the total amount so distributed was less than the sum ilable for dividend on June 30, 1914.

The Association also desire to secure power to issue or dispose of ordinary or preference stock, at such price as the Directors may nk advantageous, "whether equal to the nominal amount or above below that amount." The whole of the debenture stock has been ied subject to the condition that it shall be redeemable at the ion of the Association at the price of £105 for every £100 of stock, any time upon six months' notice ; and it is sought to confirm this ndition, and that the Association shall be empowered to attach a like ndition to future issues. The cancellation of any debenture stock eady so purchased by the Association is provided for, the issue of v debenture stock to pay off that existing, and the formation of a d for redeeming any debenture stock at maturity, &c.

t shall not be necessary for the Association to hold more than one dinary meeting in any year ; and the Directors may, without calling ckholders together, declare an interim half-yearly dividend.

The final portion of the Bill deals with the constitution of the Board the Association.

CO-PARTNERSHIP AND THE FUTURE.

ssage from Mr. Charles Carpenter, D.Sc., to South Metropolitan Co-Partners.

The Christmas issue of the "Co-Partnership Journal" of the South etropolitan Gas Company opens with the following message to the ployees from Mr. Charles Carpenter, D.Sc., the Chairman of the mpany,

The past year has been a trying one for our co-partnership. Unlike ny industries, the business of gas manufacture has become much less ofitable by reason of the high price paid for coal, with the result that, the automatic arrangement of the sliding-scale, the bonus available co-partners has been seriously reduced. In this respect they share th the shareholders and the consumers of gas the burden of hard nes. Yet, in spite of this, our employees are taxing themselves to the tent of £250 per week in order that the dependants of those who are hting for, and also of those who have fallen in defence of, our be- ved Empire may be assisted in their weekly wants. This sacrifice comforts on their part speaks splendidly for the animating spirit of r co-partnership, and goes to prove how solid and secure is the foun- tion upon which it rests. How often must many of us have thought, en reading of labour troubles here, there, and elsewhere, "What a od thing it would be if the country were one huge co-partnership, ere the aim of everyone was not only to do his bit but his best, in its ur of trial!"

We may pride ourselves upon the fact that, through good and evil pute, we have done our best these last six-and-twenty years to prac- e, as well as to preach, principles of mutual trust and effort. If more the nation and more of its leaders, whether of workmen, or of pital, or of politics, had listened to our endeavours to arouse their thargy or dispel their prejudice, there is no doubt the nation would ve found itself to-day incomparably better equipped to meet the on- aughts of its enemies.

Serious though the position is to-day, the industrial war which is und to follow the conclusion of the present bloody one is likely to be aged not less bitterly. The nation will then be in great need that all e inhabitants of this land, whether men or masters, shall have fitted emselves to meet the new conditions of wages which are bound to ise.

As co-partners, we can honestly urge them to give an important ace to co-partnership in those considerations of increased security d efficiency to which attention should be given during

THE NEW YEAR.

* * *

Neath Labour Dispute Ended.—Labour trouble has threatened the Neath Corporation Gas-Works ; but fortunately a cessation of ork has been avoided, notices tendered by the men having been ithdrawn unconditionally. The dispute originally only affected a w of the yardmen ; but the other workers had given notice in mpathy. The men asked for an increase of 4d. per eight-hour shift, ringing the rate up to 5s. The Corporation expressed their willing- ess to concede the increased pay, provided the day men worked a ine-hour shift.

BRITISH COALITE COMPANY, LIMITED.

The Present Position of Affairs.

A considerable number of shareholders attended the ordinary general meeting of the British Coalite Company, Limited, at Salisbury House, E.C., last Thursday, to hear what Mr. W. J. FISHER, J.P. (the new Chairman), had to say with regard to the report and accounts for the year ended Sept. 30, and the present position of the undertaking. The substance of the report will be found on p. 655 of last week's issue of the "JOURNAL." The proprietors were met by a considerably changed Board—only two of the former Directors (Messrs. J. Conchie and S. N. Wellington, the Company's Consulting Engineer) remaining. Four other Directors (including the Chairman) joined the Board last July ; a fifth (Mr. H. Willmott) at the beginning of this month.

The CHAIRMAN opened his remarks with a reference to the balance-sheet, as to which he said it was "perhaps better than most of its predecessors." The capital authorized remained the same, as did the deferred shares issued, while there had been an increase of 4750 in the number of ordinary shares issued, in connection with the scheme of re-organization carried out last year. Of the debentures, the 5 per cent. first mortgage debentures were about to be paid off, consequent on the sale of the Barking property, on which they were secured ; and there had been an addition made to the number of second debentures issued, in order to provide capital to meet establishment charges and indebtedness in various directions. The Company's indebtedness, at the end of the financial year under consideration, still amounted to some £12,800 for accrued debenture interest, law charges, loans, &c. On the other hand, they had to set against the extinction of the first mortgage debentures the loss by sale of the Barking land. The original cost of this was £144,553 ; and it was sold by the previous Board for £71,500. The next item on the credit side, the Wednesfield land, should prove to be worth a great deal more than its purchase price of £22,192. Alluding to the advent of the new Board, the Chairman said, although he could not profess that "they had made themselves fully acquainted with the somewhat tangled past history of the Company, it did not take them long to discover that they had succeeded to a rather troublesome legacy of debt." This they were gradually clearing off ; and they hoped that at no distant date the burden would disappear from the books. For the present, their only means of doing this was by placing some of the second debentures ; and in the near future they trusted, not only that their holding in the Barnsley Smokeless Fuel Company, Limited, would become a considerable source of revenue, but that the improved position of the Company would enable them to place some of the unissued share capital. The completion of the sale of the Barking land, and the consequent extinction of the first mortgage debentures, should considerably improve the value of the second debentures, inasmuch as they would then become the first charge on the Company's properties. The purchase and sale of the Barking land did not, on the face of it, look like a very good bargain. However, they hoped that the £71,500 for which the land had been sold did not represent all they would eventually obtain from the sale. The purchasers were the County of London Electric Supply Company ; and they proposed to erect on a portion of the land a large generating station. Negotiations were in progress with a view to working in co-operation with them on the lines of their taking from works to be erected the necessary gaseous fuel for use under their boilers, in place of coal. While he could not at the moment go into details as to this proposal, they had every hope that the arrangement, if carried out, would result in material benefit to this Company. In that case, the gaseous fuel they would supply would, of course, be subsidiary to other products resulting from the distillation—consisting of coalite itself, and various bye-products, including toluol, benzol, cresol, &c. Assuming, as they confidently did, the full success of the plant at Barugh, there should be no difficulty in obtaining all the money that would be required for the much larger plant at Barking ; and they might anticipate being able to erect similar plants in various parts of the country, either on a royalty basis or by the formation of other subsidiary companies, as in the case of the Barnsley Smokeless Fuel Company, in which they held the bulk of the ordinary shares.

THE BARNSLEY SMOKELESS FUEL COMPANY.

Proceeding then to deal with the Company just named, the Chairman said the shareholders would have learnt from the Directors' report that the plant of the Barnsley Smokeless Fuel Company was in process of erection at Barugh, near Barnsley, under the direction of Mr. Stephen Wellington, and that, unfortunately, owing to circumstances beyond control, the cost had been greater, and progress had been slower, than was anticipated. The work, however, was proceeding satisfactorily. In this connection, he might say that arrangements were being made for the issue of the remaining £30,000 of 6 per cent. debentures of the Barnsley Smokeless Fuel Company, of which he had every hope the Treasury would again subscribe for a portion. Of the £20,000 already subscribed, the Treasury had taken one-half. The Company had also a contract with the Secretary of State for War to supply the Government with the whole of certain of their bye-products at market rates.

THEIR PROPERTY IN THE MIDLANDS.

Reference had, the Chairman continued, been made to the land at Wednesfield, which, though undoubtedly a valuable asset, had hitherto not only produced nothing, but had been a source of considerable expense, inasmuch as there, also, a plant was erected some years ago, and after a time disposed of. What would be the eventual use of the land, the Board were not at the moment prepared to say. It had a value undoubtedly, and the Directors believed a good one. In the balance-sheet, this was shown at cost ; but it might, he thought, be taken as having a far greater value than that. This was some set-off against the loss on Barking. Some shareholders might remember that as long ago as 1907 a well-known coal-mining expert, Mr. C. E. Rhodes, in a report made to the Company, testified to the existence of a million tons of coal lying at no great depth below the surface. Coal was not likely for some time to fall to a very low price ; and they might therefore endeavour to dispose of the Wednesfield coal on a royalty basis, or to arrange for the erection of a low-temperature distillation plant for the treatment of the coal by their process. Before the outbreak of the war, the Company had begun negotiations with one of the largest of the London municipal electricity supply undertakings, for the construction of a plant capable of carbonizing 500 tons of coal a day. The whole of the gas generated from this would have been taken by the municipality as motive power for generating electricity; and for the coalite and bye-products a ready market could undoubtedly be found. There was every hope that when peace came again, these negotiations might be resumed and have a successful issue. With reference to what were called the bye-products of the process—such as toluol, benzol, cresol, tar, and other substances—there was not only a good market, but one that was rising steadily in value and importance. Apart from the toluol and cresol, the main value of which was as a basis for the highest form of explosives, there were the valuable dyes derived from coal tar. "Unless," he said, "we are, as a nation, to profit nothing by the lessons of the present war—a proposition that is wholly unthinkable—this Company should in the future find a fruitful field for these products; and it must not be forgotten that by the low-temperature process of distilling coal—that is to say, by our patented process—the quantities of these substances obtained by us are many times greater than are obtained by the ordinary gas-works distillation of coal." As to the patents, they were not only jealously protecting them, but had in the course of the year added several to the number. These dealt more particularly with retort-setting and discharging and quenching the coalite—two very important operations.

PROFESSOR LEWES AND MR. T. PARKER.

The Chairman concluded: "I have, unhappily, to finish on a somewhat sad note. It is with very great regret that I have to record the death of Professor Vivian B. Lewes, who almost from its beginnings was closely associated with the development of the coalite process, and in whom we have lost a loyal and consistent supporter of the low-temperature carbonization of coal. Further, I have to record with equal regret the death, within the last few weeks, of Mr. Thomas Parker, the inventor of the coalite process. Both these gentlemen had rendered eminent services to Science, and their deaths may truly be considered a national loss." He then formally moved the adoption of the report and accounts.

Mr. H. Willmott, in seconding the motion, said he had been induced to take a seat at the Board by the belief that the Company had good prospects. He understood that Mr. Wellington had found means of improving the original process. They had such a property, he felt, that they would all be glad to be associated with coalite. There had been many imitations coming along during the last ten years; and they must have seen that there was something in the idea, or they would not have put their money down.

Mr. G. Pratt inquired who was advising the Company in the first place to buy the land at Barking at so extravagant a price.

The Chairman replied that he could not say who was responsible for it.

Mr. W. H. Behrens, referring to the Barnsley installation, remarked that if it proved a success there was an immense field for future development in that coal area alone. He hoped one effect of the war would be to wake the nation up to the waste in regard to what was probably the most valuable asset of this country. For very many years, England had been in advance of the whole world in the production of coal and its application for various purposes; yet they had let another country pass them in connection with almost every industry that was allied to coal distillation. Even for the erection of the ovens necessary, they had had to go to Germany.

The Chairman, in dealing with some remarks made by a shareholder as to the quality of coalite, said he believed that originally it did project a sort of powder into the rooms in which it was used; but except for this, it was quite satisfactory. Later makes of coalite were, he agreed, not so good. With the present plant, however, it was very satisfactory; and they anticipated that, when they reached the fullest capacity, the coalite turned out would leave nothing to be desired.

The resolution was then carried unanimously; and thereafter the retiring members of the Board and the Auditors were re-elected, and the Chairman and Directors were thanked for their services.

COLONIAL GAS ASSOCIATION, LIMITED.

At the Meeting of the Association which is to be held on Thursday of this week, the Directors will present accounts for the year ended June 30, which show that, including the amount brought forward from last year, and after providing fully for depreciation, debenture and other interest, adding £410 to the reserve fund account, and deducting the interim dividend paid last May, there remains a sum of £6064 available for final dividend. This the Directors recommend to be at the rate of 3 per cent. (making, with the interim dividend of 3 per cent., 6 per cent. for the year); leaving £1891 to be carried forward to next year's accounts. Owing, however, to insufficiency of capital, all available funds have had to be used for absolutely necessary capital purposes; and these funds will have to be released by the issue of fresh capital before such dividend can be paid. Resolutions with regard to the raising of additional capital will be submitted for the approval of the shareholders.

As compared with the previous year, the sales of gas show an increase of 8 per cent. In addition to the issue of shares consequent upon the purchase of the Footscray undertaking, the share capital was increased during the year by the issue of 1315 shares of £5 each, at par. Eighteen additional debentures of £100 each were also issued at par. The Directors announce with regret the death of their colleague Mr. William Swinburne, who had for many years taken an active part in the management of the Association in Australia, and latterly acted as Managing-Director. Mr. Samuel E. Figgis, for a long time Engineer and General Manager of the Ballarat Gas Company, now acts as the Managing-Director in Australia.

FACTORY AND WORKSHOP LIGHTING.

Records of Observations.

During the months of September and October last, a considerab amount of space in the "Journal" was devoted to the task of ful dealing with two volumes of the first report of the Departmental Con mittee on Lighting in Factories and Workshops. Vol. I. contained th Committee's report and appendices; Vol. II., the minutes of evidenc and now Vol. III. has made its appearance, in the shape of records observations. On the preparation of the material for this last volum much time and care must have been expended; for there are close upo 200 pages, mostly filled with figures and diagrams.

It is stated that the records of observations contained in this appe dix were secured in the winter months of 1913-14, at the instance of th Committee, in order to reveal as far as possible the lighting conditio under which some of the chief industries of the country are carrie on at the present time. The actual observations were made by M J. W. T. Walsh, B.Sc., of the National Physical Laboratory, and M. G. F. Sedgwick, H.M. Inspectors' Assistant, under the direction of th Secretaries of the Committee; and the Committee indicate their i debtedness to the two observers for the thorough way in which the carried out their work. The records are not put forward with an claim to being exhaustive. It is, in fact, admitted that they must n be regarded as giving more than a very general idea of lighting co ditions in certain representative factories in the engineering, textil and clothing industries. The relatively short period each day durin which factories are working under artificial light, affords only a limite opportunity for observations after dusk; but use was made of pract cally all the available time during which such observations were at a possible.

The selection of factories was made as representative as practicable and, in the opinion of the Committee, for the chief industries studie the average results given in the summaries would not in most case have been much affected had a larger number of obserations bee available. Generally speaking, the observations were made in eng neering, textile, or clothing factories in and around London, Glasgow Belfast, Manchester. Leeds, Liverpool, Newcastle, Nottingham, She field, and Bristol. It was originally intended for measurements to b made in the Birmingham and Cardiff districts; but time did not pe mit, and therefore this work had to be left for a future report. As th result of a preliminary tour by one of the Secretaries, both well an indifferently lighted factories were selected; the total number chose being 54. In many cases, the factories were too extensive to perm of the taking of observations in all the rooms; and then rooms wer selected which were as far as possible representative of the lightin conditions throughout the factory. Where the factories had both ne and old sections, the choice of rooms for observation was divided a evenly as possible between the two.

Then, in each room the selection of observation points was carrie out on the same principle; attention being in the main directed to th illumination at floors and gangways, and also at the point where wor was being carried on. The method adopted was to place the whit test-card at the observation point and measure the illumination. Whe gangways and floors were being dealt with, the card was placed on th ground in one or two representative positions; a point being usuall chosen which would serve equally well for observations by both natura and artificial light. The Committee remark that the illuminatio at any point by artificial light is in ordinary circumstances a fairl constant quantity. Changes are liable to occur owing to fluctuation of the supply pressure, or to accumulations of dirt on the lamps an fittings; but in any well-regulated installation changes due to suc causes are not great, and the recorded observations may be taken a showing definitely the illumination at the various points by artificia light. The matter is, of course, otherwise with natural lighting; bu this section of the observations there is no need to deal with here.

In connection with every one of the 54 factories visited, a plan o the room (reproduced to scale) appears in the report, showing th points at which the observations were made; and full details are give of the means of lighting adopted, the results of the tests, and the Committee's opinions as to the adequacy or otherwise of the illumination A full page is allotted to every room in which observations were made and the rooms are grouped according to the industries and processe carried on in them. Each group of records dealing with a special industry or process is preceded by a summary, in which an effort ha been made to collate all the results for the industry, and present the in a way which will enable a general survey of the lighting condition to be obtained at a glance.

Factory Floors.

Measurements of the illumination at floor level were made in nearly all the factories visited. In the majority of cases it was found that attention was paid to the general illumination of workshops by providing for a certain number of general lighting units. But in some instances no such provision was made; the lighting units being placed solely with the object of illuminating some point of work, and the floor illumination being left to chance. The results in practice of this procedure, though sometimes fairly good, were often unsatisfactory. Sometimes it led to even dangerous under-illumination of certain parts of the rooms where no work was being carried on, but over which it was necessary for the workpeople to pass. Some of the rooms in the spinning-mills visited were particularly noticeable in this respect. In these, the lighting units were placed about 6 feet from the floor, along the alleys between the frames; the result being that, owing to obstruction of the light by the frames, the main central alleys, running at right angles, were left with an amount of light which appeared to be quite inadequate.

A general analysis of the floor lighting shows that in foundries 36 per cent. of the observations were below 0·25 foot-candle, 63 per cent. below 0·5 foot-candle, 76 per cent. below 0·75 foot-candle, 85 per cent. below 1 foot-candle, 90 per cent. below 1·25 foot-candles, 93 per

t. below 1·5 foot-candles, 95 per cent. below 1·75 foot-candles, and per cent. below 2 foot-candles. In the case of all other factories an foundries, the figures were 24 per cent. below 0·25 foot-candle, per cent. below 0·5 foot-candle, 71 per cent. below 0·75 foot-candle, per cent. below 1 foot-candle, 91 per cent. below 1·25 foot-candles, per cent. below 1·5 foot-candles, 97 per cent. below 1·75 foot- ndles, and 98 per cent. below 2 foot-candles. Thus in the case of ndries only 4 per cent., and with other factories only 2 per cent., of observations exceeded 2 foot-candles. The point above and below ich there were equal numbers of observations was 0·4 foot-candle in case of foundries, and 0·5 foot-candle for other factories.

WEAVING SHEDS.

Taking the industries separately, the first dealt with in the report is aving; and here, of the eleven sheds visited, artificial light measure- ents were made in nine. In most cases the lamps were shaded by amel or opal shades of the ordinary shape; but in one shed a new rm of metallic reflector was in use, and was stated to have been und a distinct improvement. The usual method of placing the lights to have one lamp over every pair of looms; or, in cases where the ndle power of the lamp is higher, one over the centre of every group four looms. Generally, the height of the lamps is from 5 to 7 feet, hich is as low as they can be put without causing inconvenience to the eratives moving about under them. With such an arrangement as is, it is remarked, it is clear that the ordinary form of shade is unsatis- ctory, on account of the glare due to the rows of bare lamps seen on ising the eyes from the looms. The improvement in this direction om the use in some cases of metallic reflectors was very noticeable.

The observations indicated a decided leaning towards an illumination between 1 and 2 foot-candles at the surface of the cloth on the oms. Of the total number of observations, 2 per cent. were above foot-candles. In the case of the floor measurements, practically the hole of the results were below 1 foot-candle. The point above and low which there were equal numbers of observations was 2 foot- ndles in the case of the looms, and 0·4 foot-candle for the floors.

SPINNING AND INCIDENTAL PROCESSES.

Under this head, measurements were made in 22 rooms; and the stems of lighting met with included batswing burners, upright and verted incandescent mantles, high-pressure gas, and electric glow mps. In many cases where no special lights were provided to illumi- ate the gangways, these were found to be very badly under-illumi- ated. As to the lighting of machines, the results show a considerable versity in the values, with a tendency towards an exceedingly low umination in many mills. Approximately, 3 per cent. of the obser- ations were above 4 foot-candles; the point above and below which e number of observations were equal being 0·6 foot-candle. In the se of spinning mules, there was less variation in the illumination; t over 60 per cent. of the observations were below 0·5 foot-candle—e point above and below which the number of observations were qual being 0·4 foot-candle. In the case of the floors, the mid-point as 0·6 candle.

LACE AND HOSIERY MAKING.

Of ten rooms in lace factories which were visited, two were lit by ectric incandescent lamps alone, four by high-pressure gas (in one se with a subsidiary system of electric lighting), and four by batswing urners. The last-named system, it is remarked, was obviously quite sufficient; and the workers complained of the poorness of the illumi- ation. In the large majority of lace-machine rooms, the chief require- ent is a moderate general light over all the working parts, and the ossibility of producing a high local illumination at any desired spot. or this purpose, the most suitable system of lighting seen consisted counterweighted lamps, capable of being readily pulled down and irected towards any particular point which it was desired temporarily illuminate. In regard to lace machines, the point at which there ere an equal number of observations above and below was 0·7 foot- andle; but the observations refer mainly to the general illumination, nd not to the local illumination available at need. The mid-point in e floor observations was 0·35 foot-candle—indicating that compara- vely little attention can have been paid to the general illumination. Vith the winding machines, the mid-point of the observations was foot-candle.

The single hosiery factory visited was lit mainly by electricity; atswing burners being used only to aid the natural lighting on dark ays. The illumination produced seemed generally sufficient; but the ghting units were so placed that the workpeople, while tending their achines, were compelled sometimes to stand in their own light. everal complaints on this ground were received from the workers; nd an observation taken on the machine with the operative in his ormal working position gave an illumination of 0·15 foot-candle, while e unobstructed illumination averaged 1 foot-candle. Here, again, ore local lighting seemed to the investigators to be desirable; and hey suggest that adjustable lights would undoubtedly have been a reat convenience. The average floor illumination in this factory was bout 0·5 foot-candle. The points above and below which there were qual numbers of observations were 1·3 foot-candles at the hosiery achines, and 1 foot-candle at the winding machines.

GENERAL ENGINEERING.

In connection with general engineering (excluding foundries), a total umber of 43 shops were subjected to measurement of the artificial llumination. The lighting systems met with included batswing bur- ers, upright and inverted ordinary incandescent gas, high-pressure as, electric glow lamps, and arc lamps. In several factories where rc lamps were employed, the lights seemed to be hung too low to give the most satisfactory general illumination; and in this way, dense lack shadows were often formed. There was also one complaint of lare, owing to the low position of the lighting units. When electric low lamps were used for local lighting, they were frequently, but by no means always, efficiently shaded. The shades for the lamps illuminating offices and for bench work generally were mostly of the ordi- ary enamelled iron form; and it is remarked that probably in many cases parabolic or similar specially-designed shades would give more satisfactory results. For illuminating machines such as lathes, where the local light had to be close to the work, the most satisfactory kind of shade appeared to be of conical form.

For machine work, the figures indicate that there is no very definite illumination which is regarded as the best for this kind of work; and while about one-third of the observations were below 1 foot-candle, there is an equal proportion above 2·5 foot-candles. Approximately, 8 per cent. of the observations were above 10 foot-candles. The middle point—that above and below which there were equal numbers of observations—was 1·6 foot candles. In the case of bench work, approximately one-third of the observations were below 1·25 foot-candles, one-third between that and 3 foot-candles, and the remaining one-third above this. This distribution indicates that bench work is allowed a higher degree of illumination than machine work. Of the observations, 6 per cent. were above 10 foot-candles; the mid-point being 1·8 foot-candles With heavy work—such as forging, spring making, rolling, &c.—more than 50 per cent. of the observations were between 0·75 and 1·75 foot-candles; the mid-point being 1 foot-candle. The figures for floor illumination in all classes of machine shops indicate that comparatively few observations (about 24 per cent.) were above 1 foot-candle or below 0·4 foot-candle. The mid-point was 0·6 foot candle.

FOUNDRIES.

Of the eighteen foundries investigated, the chief system of lighting was by arc lamps in eight cases, by high or low pressure incandescent gas in three, by electric glow lamps in four, and by batswing burners in three. Seven of the foundries had local lighting by gas and electricity in addition to the main system. In many foundries the lighting seemed generally sufficient; but "it appeared particularly bad in those foundries lit mainly by batswing burners, some parts of which were clearly dangerous." It is pointed out that the chief disadvantage of lighting by isolated powerful sources—especially in foundries with low roofs—is the dense, black shadow cast by every object in the neighbourhood of a lamp. This makes it extremely hard to see the nature of the ground which happens to be in such a shadow; and it has been stated that accidents arise from this cause. It is particularly necessary, the report adds, that the passages and gangways of foundries should be well illuminated, as otherwise there is always some likelihood of treading upon hot metal which has been spilt in transit, but is no longer visible by its own incandescence. Approximately, 4 per cent. of the observations on the floors of foundries were above 2 foot-candles; the point above and below which there were equal numbers of observations being 0·4 foot-candle.

CLOTHING WORKSHOPS.

Measurements were made in 37 clothing workshops and sewing rooms. The lighting systems met with included batswing burners, upright and inverted incandescent mantles, electric glow lamps, and indirect lighting by inverted arcs. With sewing-machines, the light-sources were generally placed several feet away from the point of work; one source often serving to illuminate several machines. In only two factories was any attempt made at systematic localized lighting. In one of these, a small electric glow lamp in a metallic reflector was fixed to each machine, close to the work, so that the light was directed almost entirely on to the needle of the machine or its immediate neighbourhood. An electric lamp, on an adjustable arm, with an enamel shell shade, was provided in one factory for each machine. In only one room were deep metallic reflectors fitted, so as effectively to screen the lamps, which in all other cases were either unshaded or else fitted with opal or enamelled shades of the ordinary shallow conical shape.

The rooms for the purposes of the inquiry were divided into three classes: (1) Those used for sewing, either by hand or machine, on woollen or other cloth, generally of a dark colour; (2) those used for the less fine processes of cutting-out or pressing; (3) those in which the work was with white linen. A lower illumination is sufficient in rooms of the last-named class (in which the co-efficient of reflection of the material is about 90 per cent.) than that required for work on the darker materials used in the shops of the first class, with a co efficient of reflection from about 5 to 20 per cent. For sewing on coloured materials, the mid-point, above and below which there were equal numbers of observations, was 3·6 foot-candles; for cutting and pressing, 2 foot-candles; for sewing on white linen, 2·5 foot-candles; on the floors, 0·85 foot-candle.

MISCELLANEOUS INDUSTRIES.

In the seventeen unclassified rooms investigated, the systems of lighting encountered included batswing burners, inverted mantles, and electric incandescent lamps. Two drawing-office measurements taken showed an illumination of 5·5 and 3·7 foot-candles at the point of work. In other cases, the mean illuminations in foot-candles at the point of work were: Cotton-bag making, 0·25; tapestry, 3·1; Christmas card printing, tying, &c., 8·2; print colouring, 8·4; printing, from 7 to 0·93; box making, 1·2; chocolate making and packing, 1·3; cocoa packing, 1·2; chocolate packing, 0·9; and burling, 7.

* * *

Fatality to a Gas-Fitter.—At an inquest held on the body of a Birmingham gas-fitter named Bradley, who was killed by an explosion of gas at the Midland Railway works, it was stated that deceased had recently been engaged with another workman in replacing two purifiers in the sheds. When the explosion occurred, he was hurled into the air, and killed instantaneously. Harry Cotterill, a mechanical engineer at the works, said the purifiers had been fixed and the pipes laid and practically completed when the explosion took place. He was called to the scene shortly after the accident, and saw deceased lying beside one of the purifiers. The cover of the purifier had been blown off, and the roof of the engine-house was damaged. On examining the pipes and the purifiers the following day, he found all the joints and connections were apparently in perfect order. He discovered a live match in a hole, and a box of matches similar to those supplied by the Company to the workmen was also found. Witness did not think it possible for the explosion to have occurred without a naked light. A verdict of "Accidental death" was returned.

THE DUTCH BUREAU OF COALS.

[From a Correspondent.]

One of the principal matters in Holland concerning gas supply is that the Bureau of Coals, to which allusion has more than once been made in the "JOURNAL," is about to disappear. There have many times been questions raised about the Bureau; and now the Minister of Industry has declared that the Dutch Government are about to take the distribution of coal under their own control.

From an independent point of view, it must be said that the Bureau has done its work well. The principal agitation against it came from a small number of so-called independent coal merchants, who were stopped in their endeavour to bleed the Dutch coal consumers by making unrestricted war profits. In his speech before the Chamber, the Dutch Minister reviewed the operations of the Bureau. Owing to its action, he said, not a single industrial enterprise in Holland had been in want of coal. Every consumer was in a position to make a contract for a reasonable period, and at fair prices. Through the action of the Bureau, coal prices fell 2 guilders per metric ton; and as the consumption has been 9 million tons, the gain to the Dutch consumers has been 18 million guilders, or £1,500,000. Though German and British interests are represented on the Bureau, it is perfectly Dutch in character. The interests of the importers and coal merchants have been taken care of in every way.

The inauguration of the Bureau in no way hindered imports from England. In the two months preceding its installation, the imports from the United Kingdom were 156,000 tons; whereas in the two months following, the imports rose to 400,000 tons. In every way, the Bureau is working to facilitate imports from the United Kingdom, and to ameliorate international conditions. But it must be acknowledged that the Bureau has been a great obstacle to those coal merchants who tried to make extra profits on coal; and these merchants have made the great noise concerning the Dutch coal trade. This small group are still busy undermining the position; and to make the future perfectly clear, the Dutch Government are now going themselves to take in hand the distribution of coal.

THE DEL MONTE PROCESS.

Fundamental Changes—A Colliery Orders an Installation.

The Del Monte process has made a passing reappearance in the columns of the "Engineer." The patents, as our readers are aware, are now in the hands of the Oil and Carbon Products Company, Limited; and for them Mr. Walter White, of coke-oven experience, has been studying the whole process, which, by the introduction of several fundamental changes, our contemporary says, "has now been brought to a position where it seems likely to have a good prospect of success." So far, however, only plant of an experimental kind, though on a full working scale, has been constructed. But a large plant has been ordered by a Midland colliery; and it is understood this is now being made. It will consist of several units of the general type.

In the experimental plant erected at Chiswick, the retort is a steel tube about 14 inches in internal diameter and some 20 feet long. It is almost horizontal, instead of inclined as in the original Del Monte form. Within this tube a worm, made of cast-iron segments fitted on a large tubular shaft, extends from end to end, and fits fairly closely. The worm is revolved very slowly by a ratchet arrangement and conveys the coal, shale, peat, &c.—introduced through a hopper, with a sealing valve—from the lower to the upper end. The retort is set in a brickwork oven, and is heated externally by bunsen flames for about one-half of its length. The worm itself takes up a great deal of heat, and conducts it to the part of the retort not heated externally. Hence the hottest end of the tube is that furthest from the feeding hopper, and the heat gradually diminishes, so that the fuel is subjected to a greater and greater temperature as it is carried forward by the worm.

Thus far (remarks the "Engineer") the plant resembles the Del Monte fairly closely; but a very important modification has been effected. In the old case condensation took place in the retort itself, with the result that the oil was generally dirty. Under the new arrangement it takes place in a separate tube removed from the fuel, and hence the oil is much cleaner. In the experimental plant this tube lies beside and a little above the latter. From the crown of the retort branch pipes (grouped at the cooler half of the retort) lead to the condenser. The result of using branches in this way instead of a single exit, is that zones of vapour, at different temperatures, are formed in the condenser; the zone nearest to the outlet end being the coldest. Hence the hotter vapours in their passage towards the exit are progressively cooled and condensed. The condensed oils are led away from the end of the condenser through a U-tube into a drum. The fixed gases are drawn out by a fan, scrubbed, and passed into a holder, whence a portion of them is led to the burners that heat the retort—the remainder being available for other purposes.

Proceeding, our contemporary says: From this description it will be understood that, in general terms, the process consists in the low-temperature distillation of oil-bearing material by means of graduated heating in a neutral atmosphere, the vapours given off being at once conveyed to a cooler zone without a chance of being split-up by contact with heat, and recovered exactly as they leave the material under treatment. In this way there is obtained a high yield of good quality oil free from impurities. Coals give from 20 to 40 gallons of oil per ton and cannel from 80 to 100 gallons per ton; the product being very similar to a light tar, with a specific gravity of 1·05. In view of the great quantity of oil that can be recovered from cannel, plants of this kind find their chief field in the cannel districts of Lancashire, Scotland, and Wales.

A unit of the plant consists of two retorts placed side by side, with one condenser between and above them. The two retorts will work as one, being charged and discharged at the same time and by the same mechanism. The retort tubes will be 18 inches internal diameter and 20 feet long, and the pair will deal with about 10 tons of coal per day of twenty-four hours. The plant, of course, would work continuously night and day, week in and week out. The coal will be brought by suitable conveying plant up to a battery of such units, and discharged into the hoppers.

From tests made at the experimental plant with the Midland coal for which the first commercial plant is being constructed, it was found that 21 gallons of oil with a specific gravity of 1·045 were obtained The oil gave the following products on further distillation:

	Deg.	Per Cent.	Sp. Gr.	
Light oil . . .	170	5·3	·85	Yellow brown.
Second light oil.	170–230	12·6	·95	Liquid red brown.
Heavy oil . .	230–270	14·8	·988	Liquid dark red brown.
Anthracene oil .	Above 270	30·0	1·005	Viscous dark yellow brown.
Pitch	85–90	34·0	1·134	—
Loss . .		3·3		

GAS SUPPLY TROUBLES AT RIPON.

It was briefly mentioned in the columns of the "JOURNAL" last wee that, owing to the heavy increase in the consumption of gas at Ripo consequent on the presence of the military, great difficulty was bein experienced in maintaining a supply at all. When practicable, the productive capacity of the works is to be increased by the provision of additional retorts; but meantime the shortage of stokers has become s acute that an appeal has been made for voluntary helpers. The work o raising a corps of volunteers for this work was entrusted to Councillo T. F. Spence, who, in reply to a circular issued, received a satisfactor response from citizens willing to help the Gas Committee out of thei difficulty. In due time, Mr. Spence, along with Mr. Brown (the Chairman of the Gas Committee), and three others, started work on a eight-hour shift, as gas stokers; and arrangements were being made t continue this voluntary assistance until the present labour troubles ha been met.

A meeting of the Council was held—at which the gas was aided b oil-lamps and candles—when the Gas Committee submitted a repo by Mr. Matt. Dunn, of Stockton, upon the present state of the works and advocating that the Corporation should carry out certain addition and improvements, the estimated cost of which was about £7400 The scheme included the installation of vertical retorts of a capacity o 250,000 cubic feet per day. This recommendation will be considere by the Committee. The voluntary labour at the works was somewha criticized; and one member declared that if the Council had no tinkered so much with the wage question they would have obtaine qualified stokers. Mr. Brown (the Chairman of the Committee replied that the works were getting old; and unless something wa done, and done quickly, the city would be in darkness.

LOCAL AUTHORITIES AND THE TOLUOL QUESTION.

A Committee of the Kensington Borough Council, "in view of th fact that the removal of all checks on the quality of the gas supplied as suggested by the Ministry of Munitions, will be solely to the interes of the Gas Company, and entirely to the detriment of the Council an the private consumers of gas in the borough," recommend that a communication be addressed to the London County Council stating tha the Council disagree with the suggestions; and that other Metropolita Borough Councils be requested, in the event of their agreeing with th views set forth, also to communicate with the London County Counc on the lines indicated.

Having considered the letter from the Ministry of Munitions wit reference to the position of the gas companies who have undertake the work of extracting benzol and toluol for the making of explosive the Works Committee of the Westminster City Council state tha while in the circumstances they think no obstacle should be put in th way of the Government obtaining the products referred to from th manufacture of gas, it appears that, as such products will presumab be sold by the gas undertakings at a profit, an allowance should b made to consumers, in respect of any deterioration of the lighting o heating qualities of the gas consequent on the extraction of these products. The Committee recommend that representations to this effe be made to the Ministry of Munitions and to the Gas Light and Co Company.

Replying to questions addressed to him by members at a meeting the Richmond (Surrey) Corporation, in reference to the letter fro the Ministry of Munitions, stating that gas companies will be reliev of any penal consequences in case the standard of illuminating pow or calorific value is not maintained, owing to the extraction of benz toluol, &c., the Chairman of the Highways Committee said it was considered advisable to continue the tests of the gas supplied by the loc Company, so as to have them ready for reference at any future tim The salary of the gas tester was £40 per annum. Alderman Bisgo said that the products would be sold; and he asked whether it w thought fit to request the Company to reduce the charge for gas to t extent to which it might be deprived of its lighting and heating valu Alderman Simpson pointed out, however, that there was the arrangement under which, if the Company paid a higher dividend, the ra payers got the benefit of gas at a lower price. Alderman Edgar sa he did not see the use of the tests, and thought that the gas tester wou be better employed in work for the Government. Alderman Simps promised to bring the points raised to the notice of the Committee.

Over 250 employees of the Consumers' Gas Company, Toron have enlisted and are now serving with the Colours at the front, or a about to leave for overseas service.

EXPORTS OF SULPHATE OF AMMONIA.

he agricultural correspondent of the “Times,” in the course of an cle which appeared in that paper on Monday of last week, on the ject of “Feeding Stuffs for Neutrals,” contended that, if the farm- interests of our own country received the consideration they are tled to, not a ton of fertilizers or feeding stuffs would be allowed e shipped until all home requirements were fully met. He said : o take the case of sulphate of ammonia, the British farmer is ously affected by the exportations to Holland which the Govern- t have sanctioned. The position is certainly remarkable. In mal times, our yearly shipments to that country amount to from o to 3500 tons. An American trade publication states that ‘early October export licences were granted for Holland to the extent of o tons per month ;’ and there is confirmation of this in the fact that November shipments totalled over 4000 tons. The action of the vernment suggests greater solicitude for the needs of neutral ntries than for those of the United Kingdom. The quantities that allowed to go abroad—especially of sulphate of ammonia—do not sist entirely of surplus production, but, in the absence of imported stitutes, are deducted in part from the requirements for home use. ere is proof of this in the disorganized state of the markets and the rease in the price of our native nitrogenous fertilizer, which is 50s., more, a ton above the October level.”

These remarks were replied to in the “Times” on Wednesday by . F. D. Acland, who pointed out that he is the Chairman of a mmittee appointed by the President of the Board of Agriculture d Fisheries to take such steps as may be possible and advisable to sure an adequate supply of fertilizers for the use of farmers. Ad- tting the justice of the contention that the farming interest has a ht to claim that not a ton of fertilizers or feeding stuffs should be owed to be exported until home requirements are fully met, he says at this is precisely the policy which the Board of Agriculture have opted since the outbreak of war. Mr. Acland then proceeds: “It uld be of interest if the correspondent would indicate more clearly at he means by a full provision for home requirements, particularly the case of sulphate of ammonia, which he selects as an example. e normal output of sulphate of ammonia is about 400,000 tons per num, and the normal exports are about three-fourths of the total ; considerable proportion of the remainder being used for industrial rposes. Is it suggested that farmers would use what must be con- lerably more than four times their usual quantity if exports were tirely prohibited? This would involve their spending about six llion pounds on this one artificial manure—which is really unthink- le in the present agricultural circumstances. Or is it suggested that e same quantity would be produced if the market were restricted to e home demand? It is true that sulphate of ammonia is to a large tent a bye-product of gas making. But I understand that it is ssible to make gas and at the same time considerably to reduce the oduction of sulphate of ammonia, and that this might be done if e supply were to exceed the demand over any considerable period. that case, the price of gas would rise, and the farmers would get more fertilizer. This aspect of the matter is worth consideration by ose who advocate prohibition of export not so much in order to cure ample supplies, but in order to lower prices. The effect of pro- bition of export upon the Scottish shale-oil works and the coke-ovens the North of England ought also to be considered. Subject to the rmers' supplies being ample, the position of such industries is surely matter for thought and attention. With regard to supplies, the ommittee propose to act in the future on the same general lines as in e past—namely, by an arrangement with the makers of sulphate of mmonia to reserve month by month an ample supply for agricultural quirements, and to assent to the export from time to time only of ch quantities as are shown to be in excess of all home demands. armers have an entirely reasonable expectation of being able to btain during the coming months an ample supply of all fertilizers hich can be produced here in sufficient quantities. This expectation ould not be encouraged to degenerate either into a groundless belief at such supplies will not be available, or into an unreasoning demand at all exports should be stopped—however ample the supplies may e which will be retained here.”

On Thursday, the “Times” published the following letter on the bject, from “Agricola”: “Mr. Acland, the Parliamentary Secre- ry of the Board of Agriculture, asks what is meant by a ‘full pro- ision of sulphate of ammonia for home requirements of farms.’ The oard of Agriculture themselves have circularized farmers in regard wheat growing, advising them to put on 2 cwt. of sulphate of am- onia per acre in order to get an increased yield of about 25 per cent. f this is to be done, it will require about 200,000 tons. The time to ut it on would be, in two doses, about March and April. The point tried to make in my previous letter was that the Government should e that a big quantity was available, and that the farmers did put it n for the nation's benefit. As to the price the farmers should pay, it were not for the anti-Protection attitude of Mr. Acland and the ajority of the Cabinet, I believe that in this emergency the Govern- ent would have been wise even to go as far as presenting the farmers ith the material by which they could increase England's output of ood by 25 per cent., and thus save us being at the mercy of sub- arines and of foreign high prices and of the ever-increasing huge reights. Anyhow, by preventing the export of sulphate of ammonia, e might hope to see prices kept down to about the £10 at which it was quoted July, 1914, instead of £16, which is the current price for English consumption. I would also point out that Lord Selborne admits that he has failed to induce the Government to import nitrate of oda in Admiralty transport vessels; and the farmer will thus have to do without this fertilizer next spring. Even if he could have got it, it does seem ridiculous that, after freights have been allowed by bad Government management of our shipping to run up to £5 or £6 a ton of nitrate of soda from Chile, ships should be occupied in bringing over this nitrate to England, while other ships are carrying nearly 300,000 tons of sulphate of ammonia from England to the ends of the world, when all the time the sulphate of ammonia could be used to replace the nitrate of soda in English agricultural practice—thus saving both journeys. As a large farmer, I feel forced to express very strongly my view that England's interests are not being looked after, and that the foreign countries getting our sulphate of ammonia are deriving undue benefits.”

In the same issue, Mr. Roger W. Wallace, after remarking that Mr. Acland's letter showed how supine are those who direct our explosives departments, said: “The sulphate of ammonia exported to Holland is not for agricultural purposes, but for the manufacture of high explosives in Germany. The stocks of materials for producing nitrogen for explosives are very low; and it is difficult for German manufacturers to find. They cannot get nitrate of soda as we can, and are limited to nitric acid made from the atmosphere by electrical processes. This is done in the neutral countries, Norway, Sweden, and Switzerland, but in Germany only to a very small extent, as they have practically no water power. Some years before the war the German authorities recognized this, and gave large premiums to chemists to work out processes for changing ammonia into nitric acid. This they succeeded in arriving at; and it is for this purpose the sulphate of ammonia Mr. Acland advocates being allowed to go to Holland is to be used. The Germans may find substitutes for cotton; but they cannot now make at a reasonable price nitric acid in any other way than from ammonia. The President of the Board of Agriculture announces that nitrate of soda cannot be obtained from Chile because of the exceptional demands for freight. If this is so, why not let the farmers have cheap the ‘Holland’ sulphate of ammonia, which is in nearly every case in agriculture an equivalent for nitrate of soda?”

The next issue of the “Times” (that for Monday) contained the following letter on the subject written by Mr. D. Milne Watson, in his capacity of Chairman of the Sulphate of Ammonia Association: “Allow us to state that we are reserving enough sulphate of ammonia to supply British demands for nitrogen, even supposing that not one single ton of nitrate of soda is shipped. As regards the price, it is true that £10 was accepted in July, 1914; but this was due to artificial depression in the market brought about by the manœuvres of the German Syndicate. A fair average pre-war price for sulphate of ammonia was £14 per ton. Owing to the war our costs of manufacture have risen by over £3 per ton; so that we are not making a penny per ton more profit at present prices than we were before the war. These facts will give agriculturists the measure of the sacrifice which manufacturers of sulphate of ammonia have agreed to accept in selling at £14 10s. for autumn dressing. We agreed to take this burden upon ourselves in order to encourage farmers to make the experiment of applying sulphate to autumn wheat—a practice which has been attended with very successful results on the Continent. If the experiment is a success, we recognize that our outlet in the home market should be considerably increased in future years. If the Government wish to intervene, we are willing to reduce the price of sulphate of ammonia by £1 per ton for every £1 by which the cost of manufacture is reduced. The Board of Agriculture have, however, in the past persistently ignored sulphate of ammonia, and recommended nitrate of soda—a foreign product. But we may say that, as far as the supply is concerned, the Board have now taken all the necessary steps, in conjunction with ourselves, to secure the supply to agriculturists. We should be only too pleased to be able to sell the whole of our production at home; and we shall be highly gratified if even double the normal quantity of 60,000 tons is used this season. As regards Holland, your correspondents appear to be unaware of the fact that in normal years Holland has been a large buyer of German sulphate of ammonia which she is now, of course, unable to obtain. In addition to this Holland consumes a very large quantity of nitrate of soda, which she has been unable to obtain this year. It is, therefore, perfectly natural that she should wish to replace these deficiencies by buying British sulphate of ammonia. The arrangement by which sulphate of ammonia is now being exported to Holland in limited quantities was made at the direct request of the Dutch Government, and that Government has no doubt satisfied our Government concerning the uses to which the sulphate will be put. Mr. Roger Wallace has apparently not heard of the success of the Haber process in Germany, and implies that synthetic nitrogen is only being made to a large extent in neutral countries. The facts are otherwise. The Badische Company are at the moment, according to their own account published in German newspapers, producing at the rate of 300,000 tons of sulphate of ammonia per annum; and in view of the increase in the production of cyanamide in Germany, it seems more than probable that the German claim that they are independent of nitrogen from outside sources is perfectly correct.”

On the same day, another correspondent—Mr. Christopher Turnor—wrote in these terms on the matter: “Mr. Acland's letter will bring small comfort to the practical farmer at present requiring sulphate of ammonia and other artificials. His argument is that we agriculturists do not really understand the situation in regard to artificials—not having the inner information which is at the disposal of the Board of Agriculture. But I think we have quite sufficient evidence at our disposal to entitle us to reject Mr. Acland's contention that there is so much sulphate of ammonia in the country that the manufacturers thereof must export large quantities or else reduce their output. The chief point to understand clearly is that, as the Board of Agriculture itself admits, there will be a serious shortage of nitrate of soda. Sulphate of ammonia is the only alternative nitrogenous artificial. My own practical experience is that at this moment it is very hard to get quotations for sulphate of ammonia at all; and such quotations as I have received are at £16 10s. and £16 15s. a ton. This does not bear out the contention that there is a superabundant supply. At this time last year the price was £12 10s. a ton. Mr. Acland cannot conceive how our farmers can possibly use an extra £6,000,000 worth of sulphate of ammonia. For myself, I see nothing impossible in their doing so, if the supply of nitrate is greatly reduced, and if our farmers begin to use artificial manure at all to the extent that it is used on the Continent. The Board of Agriculture have attempted to encourage farmers to use sulphate of ammonia by saying that they shall have it at £14 10s. a ton if they use it as an autumn top-dressing for wheat and apply it before Dec. 31. Now there are two considerations that make this limitation unreasonable. First, in many parts of England the wheat crop is unusually backward, and for some time back the land has not been in a condition permitting the application of the sulphate. Secondly, in Denmark, where the use of artificials is very thoroughtly understood, the top-dressing of sulphate is often applied as late as April. In spite of all that Mr. Acland has said, I feel the large export of sulphate of ammonia to be most unwise. I quite understand that the Government is anxious to export any and every thing it possibly can; but this policy must not be carried out at the cost of lessening production in this country. A further point is that the larger amount of this exported sulphate goes to Holland; and even if this is all actually used in Holland itself, it is employed for growing food which is exported to Germany."

A letter referring to the original statements in the "Times," written by Mr. D. Milne Watson, the Chairman of the Sulphate of Ammonia Association, appears in our "Correspondence" columns to-day.—Ed. J.G.L.

* * *

Fatality at the Dudley Gas-Works.—The Jury returned a verdict of "Accidental death" at an inquest on the body of Walter Crow, yard foreman at the Dudley Gas-Works. Deceased and a labourer were engaged in removing bricks from a wall at the works, in order to release some coal behind it, when the wall and a brick pillar suddenly collapsed, killing Crow instantly.

Humphrey Pump Company.—The Directors, in their report for the twelve months to Sept. 30, regret that the war continues to seriously affect the business of the Company. The Company's claims in connection with the large pumping contract at Mex, Egypt, have not yet been finally settled. Certain outstanding contracts have been completed. Installations have been set to work in Italy and India by licensees. The principal work accomplished has been the development of a new type of pump more suitable for manufacture in small sizes, leaving the original Humphrey pump for large installations. Notwithstanding the exceptional call made upon their time and attention by the Company's affairs during the year, the Directors have, owing to the war, decided to forgo their fees for the year.

Bilston Gas Company.—The Directors' report for the year ended Sept. 30 states that the profit and loss account, after paying the usual interim dividends, shows a credit balance of £15,986. It is proposed to pay further dividends of 5s. 6d. per share on the "A" shares, less tax, and 4s. per share on the "B" shares, less tax (making, with the interim dividends, 11s. and 8s. per share respectively, less tax, for the year), leaving thereafter a balance of £13,648. In consequence of the increased cost of fuel, &c., the Directors were compelled to raise the price of gas 3d. per 1000 cubic feet to ordinary consumers, and other rates in proportion, as from Sept. 30 last. This increase in price will not, however, cover the increased cost of manufacture; and unless the price is still further advanced, it will probably be necessary to draw upon the balance carried forward for maintaining the customary dividends next year.

EFFECT OF GAS UPON ORGANS.

Reference has been made in the "Bulletin of the British Commercial Gas Association" to the good work that has been done in regar to alleged damage caused by gas-radiators to organs, and the way i which it has been found possible to so completely turn the tables as t get gas employed for the preservation of organs from damage by damp The matter originated with a letter in the "Musical News" last year in which the writer laid the blame for ciphering troubles and the corrosion of the metal work in an organ on gas-radiators with which th church concerned was heated. This complaint the Association mad the subject of a careful investigation; and at the same time an experiment was started at another church in London, where similar troubl had arisen. The result of this work was set forth in an article published in the "Musical News" for Sept. 4 last, which the Associatio have had reproduced as a pamphlet, together with some gratifying testimonials to the use of gas-fires in rooms where there are pianos.

The "Musical News" says the complaining letter which appeared i the first place did not produce much effect, judged by any correspondence it called forth; but as its statements seemed on the face of the to challenge the desirability of having gas-radiators in a buildin where a large and expensive musical instrument stood, it attracted th notice of the British Commercial Gas Association, with whose representative they had an interview. He assured them that the troubl could not be caused by the gas-steam radiators, as there were ver many churches so heated from which no complaint had been received and he pointed out that ciphering and the other troubles mentione were experienced long before any form of gas heating had becom common in churches—in fact, they still occur where no gas is use either for lighting or heating. The remainder of the article is give in our contemporary's own words.

Experiments in Search of a Remedy.

There was force in this contention, and taking into consideratio the interest of the subject to a large proportion of our readers, w invited the representative of the Association to place his views befor them; but he said that those connected with the gas industry wer giving the problem close attention. Experiments were actually i hand with a view to demonstrating that—whether gas or any othe form of heating was or was not the cause of such troubles—gas coul if properly applied, prove a certain remedy for them. In these circumstances, we withheld any comments on the matter until thes experiments were completed. After nearly a year and a half, definit and reliable results have been obtained; and as the whole subject i one of great importance to churches and organ-builders, as well as t organists themselves, we are glad to refer to them in detail.

The gas engineers who conducted the experiments set themselve the task, first of discovering the cause of the evil, then of designin

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iple apparatus for its prevention. Their report has been placed r hands; and it runs to the following effect.

It has been found by experience that many pipe organs, no natter what system of heating or lighting is in use in the buildngs in which they are installed, suffer materially in the following vay. The metal parts are subject to fairly rapid corrosion, specially the wires and similar working parts, and the stops and neumatic pistons are apt to stick. The effect of this action is to naterially lessen the beauty and regularity of the music obtainble from the instrument. It also necessitates more frequent epairs to the organ, and materially shortens its life.

It has been clearly proved that the cause of the abovenentioned defects is the fact that in churches and similar buildngs which are not in constant hourly, or in many cases even laily, use, or when used are frequently only partially so, the temperature of the air and the surroundings in the inclement seasons of the year drops to a very low point during the period when the building is either entirely unused or is not in full use. Dampness is also experienced in some cases. When the building comes into use, some form of apparatus for its general heating is started—usually some little while before the congregation or audience enter the building. The temperature then rises fairly rapidly; and the effect of this, and the heat and moisture arising from the congregation or audience when they assemble, is to cause air containing moisture, and at a temperature materially greater than that of the organ itself, to come into contact with the metal wires and plates, wooden stops, and other working parts of the organ. This causes condensation to form on the metal, and oxidization, &c., to ensue, causing the subsequent corrosion of the metal. In addition to this, owing to the fairly sudden changes in temperature during heating or cooling off, uneven expansion and contraction take place according to whether the parts are metal or wood. Stops and pneumatic pistons are also affected, and have a tendency to stick.

The result, from a musical point of view, is that, owing to the sticking of the stops, &c., and the corrosion of wires which pass through similarly corroded metal plates, the instrument does not give forth the perfect intonation and effect that the organist desires, and ciphering frequently takes place owing to a wire or wires acting in one direction, but failing to return owing to the jamming of the corroded wire or wires in the corroded metal plate. Destruction and breaking of wires also occur far more rapidly than is warranted by fair wear and tear. The corrosion is usually materially accentuated by the fact that the air of the average town contains a proportion of sulphur, which, when deposited on the metal with moisture, hurries the corrosive process.

It has been discovered that a means of preventing the trouble herein explained is to keep a constant stream of warmed dry air passing over the internal parts of the organ during the inclement months of the year, so that the temperature of the organ and these internal parts is always kept above that of the general air and the contents and structure of the other parts of the building—indeed, if necessary, it would thereby be possible always to keep the air in and around the organ at what may be termed normal summer temperature. When such a system is properly carried out, the organ remains quite unaffected by the rapid and extreme changes in temperature previously explained; and the consequent dryness, absence of corrosion, and absence of repeated expansion and contraction of the parts improve the tone, life, and working of the organ.

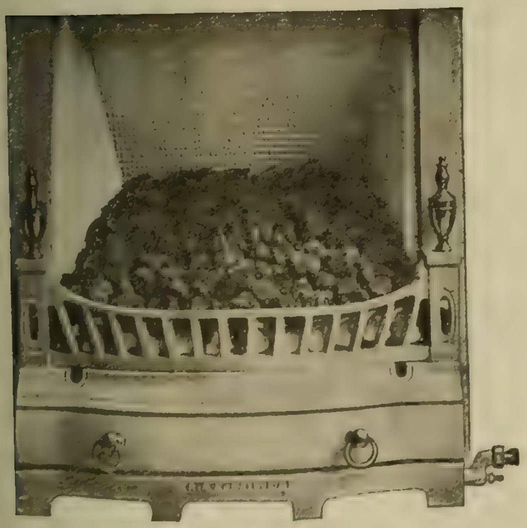
It would seem at first sight as if the suggested remedy called for an elaborate scheme of heating and ventilation, or at least one of some magnitude, in respect to primary cost and the subsequent annual running cost. It is claimed, however, that this was not the case; and by the courtesy of the authorities of the New College Chapel, Upper Avenue Road, London, N.W. (where the gas experts were carrying out the experiments mentioned above), we are able to describe an apparatus which, after having been in use the whole of last autumn and winter—a particularly damp season—has proved to have achieved the desired result. The apparatus in this case is heated by ordinary coal gas, which is very economical and easily regulated; but when this is not available, the same results can be obtained by the use of acetylene gas, petrol gas, or even electricity, or oil.

A Simple Gas Heating and Ventilating Apparatus.

For the purpose of generating and inducing a constant stream of warmed, dry air to pass over the working parts of the organ, the engineers constructed two special air-heaters with flues running into the organ—one at the front and one at the rear—in order more evenly to distribute the warmed air, and thus reach all material parts of the organ. The air which comes into contact with the exterior of these flues is also warmed slightly, thus assisting the process. Owing to the construction of the air-heaters, the warmed air contained in, and delivered by, the flues does not pass through the chamber containing products of combustion from the heating agent.

The air-heaters, which are made of iron, are constructed as follows: They are each divided into two separate chambers by a plate, and have holes perforated in the front of the upper chamber, from the upper part of which the flues are led into the organ. The lower chamber contains a very small gas-burner of the atmospheric bunsen type. When this burner is ignited, it heats the dividing plate and also the upper chamber above it; and when the upper chamber becomes thoroughly hot, an upward movement of the heated air inside takes place. This air passing away through the flue causes a current of fresh, unwarmed air to be drawn through the holes in the upper chamber, which air is duly warmed, and, in its turn, passes away into and through the flue. This movement of air continues during the whole time the apparatus is working or being heated, and ensures the constant stream of warmed, dry air passing into the organ as previously described. The distributing ends of the flues are preferably enlarged

THE MAIN GAS FIRES.



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SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

and made oval or trumpet-shaped in order to give a greater width of spread to the discharge of warmed air.

The air-heating apparatus and air flues are perfectly safe, and were passed by the Fire Insurance authorities—a point of importance, of course. They can also be easily masked or hidden, in order that they shall not be noticeable or unsightly, and they are not obtrusively large. At the New College Chapel one of the heaters is placed on the left of the organist, and can quite conveniently be enclosed. The other one is entirely out of sight—being at the rear of the organ.

Moderate Running and Installation Costs.

Naturally the first doubt that will arise is concerning the cost. This has proved to be quite moderate, as the quantity of gas consumed hourly is very small. The chapel authorities were recommended to leave the gas constantly burning in the heaters from early October to the end of April—a period of seven months. It was estimated that at the pre-war price of gas the cost would amount to about £7 for the whole winter season; but notwithstanding that the price was subsequently raised, it was found that the whole cost came to a trifle under £5—the gas being 2s. 8d. per 1000 cubic feet. There are two other points. Besides the current cost, What was the expense of the heaters and the installation? This, we are informed, in the case mentioned amounted to less than £10.

A Great Improvement.

Then, What has been the effect on the organ itself? This is really the crucial point; and it is therefore satisfactory to hear that the organist and all concerned bear testimony to the great improvement of the organ since the apparatus was installed; while there is no trace whatever of corrosion in the action. Here and there there is some dryness, which may necessitate a little lubrication before the wet season sets in; but in these experiments this really was the result desired, as in the past the difficulty has been the effect of moisture. In this respect, it may be pointed out that excessive dryness is almost as bad an enemy as excessive moisture; but with so low an expenditure of gas, this is not very likely to arise; and, in any case, no doubt the attention of gas engineers can be directed towards obviating it. A point worth mentioning is that the constant heat generated is of some, though possibly slight, value towards the general warming of the building, apart from its special application in connection with the organ. We understand the apparatus has been provisionally protected.

Summary.

To sum up, the cause of organ troubles is primarily the extreme variations of temperature, due not only to often-marked changes in the natural atmosphere, but to the irregularity of heating methods. It is no unusual thing for a church to be heated on Sunday to 60° or more, which in the middle of the week falls nearly to freezing point. In our youth we often practised in woollen gloves, in order to retain consciousness of our fingers, whereas on a Sunday it was necessary to remove one's overcoat. If the deleterious effect of these variations can be prevented by the installation of an apparatus which is both cheap to s up and inexpensive to maintain, it is surely worth the notice of churc authorities and organ-builders. Too often a costly instrument erected, and left to its good behaviour, so to speak, with very inad quate attention beyond regular tuning, perhaps once a quarter, perha oftener. We feel sure that any device which ensures a steady temper ture would add to the life and efficiency of the instrument, and woul in the long run justify its cost.

It may be added that the apparatus for keeping the organ dry being made by the Davis Gas-Stove Company, Limited.

JARROW RAILWAY ACCIDENT.

Gas Lighting in Trains.

The terrible railway accident which occurred last Friday week nea Jarrow, when at least seventeen persons lost their lives as the result a collision (the remains in sixteen cases being so charred that ident fication was a difficult task), has led to renewed discussion in some the newspapers of the subject of gas lighting for trains; and th aspect of the matter was also referred to in the course of the evidenc given during the Board of Trade inquiry by Colonel Von Donop, Newcastle-on-Tyne.

Alexander Mitchell, the guard of the passenger train mainly i volved, said that after the collision he left his train to summon hel and on returning found the leading vehicle of it was on fire. He di not know whether any other portion of the train was on fire at the tim He thought that gas was escaping. The five rear vehicles were u coupled and drawn away. Another guard, named Robert Taylor, sa he thought it came from the roof lamps of the carriage, as the roof w alight and not the lower part. At the time he did not see anyone attemp ing to extinguish the fire. The rear vehicles were uncoupled; but could not exactly say why he did not take steps to uncouple the thi vehicle, which was not alight. He saw no passengers in the leading the second vehicle. There were no lights on his train. They were a put out at Hebburn.

Sampson Talliday, an engine driver, who was a passenger in th train, stated that he was in the second compartment of the secon vehicle. After he had managed to get out of it, he set to work liberate the passengers from the compartment in front of his. Tw passengers who were alive, and one who was dead, were left in th compartment. While he was working, he noticed a small jet of fi rising from the top of a gas-cylinder under the carriage in which th people were imprisoned. He at once sent three men to fetch the fi extinguishers which he knew would be on the train. Witness le

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Radiant Heat.

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Warrington & London.

e passengers and went under the carriage to try to put out the fire, ut without success. Finding that he could not extinguish the flames nder the carriage, he went round to the other side of the compartent, where he knew the passengers were fast. He tried to extinguish e fire there, but failed to do so; and by that time the flames were preading rapidly to the top of the carriage, and the people inside egan to shout. He was unable to say what caused the jet of flame nder the carriage; but he did not think it was due to the ashes from e engine. Witness went on to the top of the carriage, and played on e fire with an extinguisher; but it had no effect.

Mr. A. C. Stamer, Acting Chief Mechanical Engineer of the Northastern Railway Company for the construction of rolling stock, gave vidence regarding the lighting arrangements of the two vehicles. The as was carried in three cylinders in the case of the leading vehicle, nd by four cylinders in the second vehicle, which was partially urned. The vehicle of the other train which was burned also had ree gas-cylinders. The cylinders were placed underneath the ehicles, and well up into the frame. One of the cylinders was found nocked off the coach, and lying at the rear of the engine. It was the ylinder at the leading end of the first vehicle. On examination it was ound to be burst at both ends. The back of the bunker of the engine as badly scorched. He thought it was due to the proximity of the urning coach, and not necessarily to gas from the cylinder. Owing the cylinders being burst, he considered the gas quickly escaped. Vitness further stated that the other two cylinders were found in posion on the coach. One was delved in at the bottom; but he did not hink it was split. The other was burst away at both ends. The ipe connections were broken away from all the cylinders. In regard the cylinders of the second vehicle, all were in order, and in posion; and only one connection was broken. This was the leading right-and cylinder of the four. All the low-pressure pipes, however, were evered and burst. Two of the cylinders of the leading vehicle of the own train were in good order, and in their proper positions on the ain. The other one was in position; but it was burst at one end. he cylinders were not fitted with safety valves. His Company had ade one or two trials with different sorts of automatic valves, having or their object to prevent the rush of gas out of the cylinders if any of he pipe-connections were severed. The result of the experiments ith these valves was, however, unsatisfactory. They were found to e unreliable, and not to shut-off as they were supposed to do. The ompany were still making experiments.

The INSPECTOR: Have your Company taken any special steps within he last few years to take precautions against fire on trains?

Witness: Yes, we have gone into the question.

Will you kindly tell me what steps you have taken?—We have fitted 70 vans with rescue appliances and fire appliances. That is out of a otal of 836 vans which we propose to fit up. We have also fitted 924 ith a lead pipe on the low-pressure side of the gas-regulator—that is he pipe which runs up the outside of the end of the vehicle to feed he lamps.

What was the object of that?—The object is that if there is a rupture of the pipe it can be readily closed by means of a hammer. This could not be done in the case of the old steel pipes.

Proceeding, witness said that since the Company introduced incandescent gas they had found that they could reduce the number of cylinders under each vehicle, and, in order to obtain twenty-four hours' lighting, they found that they could reduce the number of cylinders in most of the vehicles to one—thus doing away sometimes with two, and sometimes three cylinders. They had altered 334 vehicles in this respect. Having regard to the condition of the cylinders after the accident, his own opinion was that it would be a very short time before all the gas was out of the cylinders. In fact, in the first coach which was burnt out, there was only one cylinder which was not ripped open, and from which the gas would have to escape by means of the connection on the cylinder.

William Dunlop, a guard, said the fire originated in the front part of the carriage, and the flames seemed to rise up from the bottom through the wreckage.

The inquiry is to be re-opened when the engine-drivers of the trains are ready to give evidence.

The inquest was opened at South Shields on Monday last week; and after evidence of identification had been given, the proceedings were adjourned until Jan. 18.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 24.

In view of the holidays, the tar products market has been extremely quiet, and without alteration in prices.

Sulphate of ammonia is very strong; and £17 5s. net per ton in buyer's bags, *ex* maker's works, has been paid for 25 per cent. quality.

Tar Products in the Provinces.

Dec. 24.

There is nothing fresh to report concerning the market for tar products. Pitch is still in the same unsatisfactory position, and, owing to the shortage of tonnage, contracts cannot be arranged. Creosote is quiet, with little or no business doing. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. to

Careful attention will be given to YOUR enquiries.

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London Office:
165, GRESHAM HOUSE,
Old Broad St., E.C.

2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¾d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 6d. naked. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 24.

Throughout the week the market for this article has continued on its upward course without any check, and a fresh record has been established in high prices since the year 1883. The nearest values at the close are £17 5s. per ton f.o.b. Hull, £17 12s. 6d. f.o.b. Liverpool, and £17 17s. 6d. f.o b. Leith. There has been good inquiry in the forward position, and it is reported that business has been done at the principal ports at £17 17s. 6d. per ton for January-March delivery, £17 10s. April-June, and £17 5s. July-December.

Nitrate of Soda.

This market has become quieter, but values are fairly well maintained at 15s. 3d. per cwt. for ordinary, and 16s. 3d. for refined quality, on spot.

Sulphate of Ammonia.

From another source, it is stated that the market for this article still continues upward; and it is reported that very high prices are being paid for delivery over the whole of next year. Outside London, makes are quoted at £16 5s. to £16 7s. 6d.; Hull, £17 2s. 6d. to £17 5s.; Leith, £17 5s. to £17 7s. 6d.; Middlesbrough, £17 2s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade is active, but the demand for Admiralty purposes is heavy, and there is little fuel free for sale for a fortnight or so. In the steam coal trade, the output is well taken up, and forward business is not very easily entered into at present. Best Northumbrian steam coals are nominally about 22s. per ton, with little for prompt sale. Second-class steams are 20s.; and steam smalls are higher at 11s. to 13s. 6d. per ton, according to quality—all f.o.b. In the gas coal trade, the shipments have been full; but the holidays intervened, and the production will be only limited till after the turn of the year. Quotations are a little varied. For best Durhams, about 21s. to 21s. 6d. per ton f.o.b. may be put as the current price; second-class gas coals are near 19s. to 19s. 6d. per ton; and "Wear Specials" are firm at 22s. to 22s. 6d. per ton f.o.b. The smallness of the prompt supply, and the fact that on the long contracts the deliveries should now be at the heaviest, make these prices largely nominal, and probably little new business is being done for early delivery. Forward contracts are often in negotiation at the turn of the year; but there is no much heard of any, and the high freight has its effect. For gas coal Tyne to London, the freight is about 15s. at present, though much coal is being carried on long contracts at considerably lower rates Coke is firm, and rather scarce. The production of gas coke is heavy and the price is about 28s. to 30s. per ton f.o.b. in the Tyne. But th high freights keep down the exports of coke also.

* * *

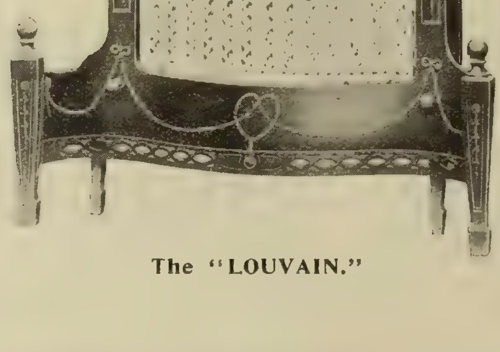
Sale of Shares.—At a local auction sale recently 500 shares of £ each in the Woodbridge District Water Company were disposed of a prices ranging from 13s. 6d. to 14s. 3d. per share. The rate of interes paid on the shares last year was 3½ per cent.

Lighting of Athens.—The "Times" correspondent in Athens states that the shortage of coal for lighting purposes has caused measures of severe economy to be taken; and the Government have ordered a reduction in the lighting of the city by one-half. The announcement on Christmas Eve of the arrival of 6000 tons of Newcastle coal was received with satisfaction.

European Gas Company, Limited.—The Secretary of the Company (Mr. W. B. Brady) intimates that the Directors have decided to pay on Feb. 1 the same interim dividend as last year—10s. per share, free of income-tax. Until the accounts are made up for the financial year it is impossible for the Directors to estimate how far the profits of the Company will be affected by the war, and what the amount of the fina dividend will be.

Lighting Matters at Hendon.—The Hendon Rural District Counci are continuing negotiations with the Harrow Gas Company, with a view to obtaining a reduction in the annual charge for street lighting It was stated at the last Council meeting that the Company were now receiving for maintenance 2s. per month per lamp on the 224 lamps in the parish of Pinner. Upon this being pointed out to the Company, a letter had been received stating that as practically the whole of the lamps were unlighted in the district they could not reduce the charge The Surveyor remarked that, under the present arrangement, the Council were paying £268 a year for nothing at all.

Maximum Coke Prices.—At a meeting at Cardiff last Wednesday of the South Wales Coke Manufacturers' Association, it was reported that a deputation had had an interview at the Ministry of Munitions in respect of a proposal to fix maximum prices for coke with a view particularly to ultimately bringing down the price of steel. The deputation stated they had agreed with the Munitions Departmen that the maximum prices to consumers shall be 30s. per ton for furnace coke, and 40s. for foundry coke, on truck at the ovens. The present market quotations for these qualities for export range 5s higher than the maximum fixed for home consumption. The deputation stated they were given to understand that the Munitions Board had already taken action for fixing maximum prices for pig iron, and also contemplated fixing maximum prices for the finished product.



The "LOUVAIN."

The "LILLE."

The "MONITOR."

MANUFACTURERS:

The VULCAN STOVE CO., Ld.

EXETER.

Telegrams: "VULCAN, EXETER."

Sedgley Gas-Works Results.

The report of the Sedgley Urban District Council Gas Committee, or the year ended March 31 last, states that the revenue from all ources amounted to £8315; and after meeting expenses, including oan repayment, a net profit remained of £1530. Of this, £750 was n March last transferred to the district fund account, and the balance dded to the revenue trading account. The Committee call attention o the fact that this is the first complete year of working of the new arbonizing plant; and, as anticipated by the Sub-Committee upon the resentation of their scheme, a substantial saving in labour has been ffected—the payment under this head being £405, against £611 for he preceding year, with a heavier amount of coal carbonized. During he year, an expert was called in upon the question of distribution; nd, acting upon his advice, it was decided to lay enlarged mains, at n estimated cost of £2650, added to which was the sum of £100 for a ew station governor, and £250 for alterations to mains at the works, nd contingencies. For this sum of £3000 application was made to he Local Government Board; but, owing to the war, sanction to orrow was refused. In view, however, of the urgent necessity of nsuring a more adequate supply to the consumers furthermost from he works, it was decided to proceed with the first portion of the cheme, defraying the cost out of the reserve fund.

* * *

Accident at a Birmingham Gas-Works.—Last week, a double atality occurred at the Windsor Street works of the Birmingham Cor- oration Gas Department; two men falling down a lift shaft a distance f about 30 feet on to a concrete floor. Assistance was quickly forth- oming; and they were removed with all promptitude to the General Iospital. One man, however, died before the institution was reached, nd the other shortly afterwards. How the accident happened is not lear, as the men were alone in the house where they had been engaged. 'he lift is an electric one; and there are iron gates on each floor which ork automatically. It is presumed that the men were leaning against ne gate when it suddenly opened.

Wages at Rochdale.—The Rochdale Town Council were recom- ended by the responsible Committee to grant to their gas workers a ermanent increase of wages, in lieu of a war bonus. Applications ad been received from the men for a reduction of hours, a permanent icrease of wages, and a week's holiday each year with pay. These emands had been carefully considered by the Works Sub-Committee, ho reported to the General Committee. It was then decided that o reduction of hours could be made. As to holidays with pay, this uestion was settled by the Council some time ago. In the matter of ages, the Committee recommend the Council to grant permanent icreases (in place of the war bonus) to 143 men. These advances epresent £780 a year; and if the amount of the present bonus is de- ucted, the net increased cost to the department will be somewhere bout £200.

Public Lighting at Southend.

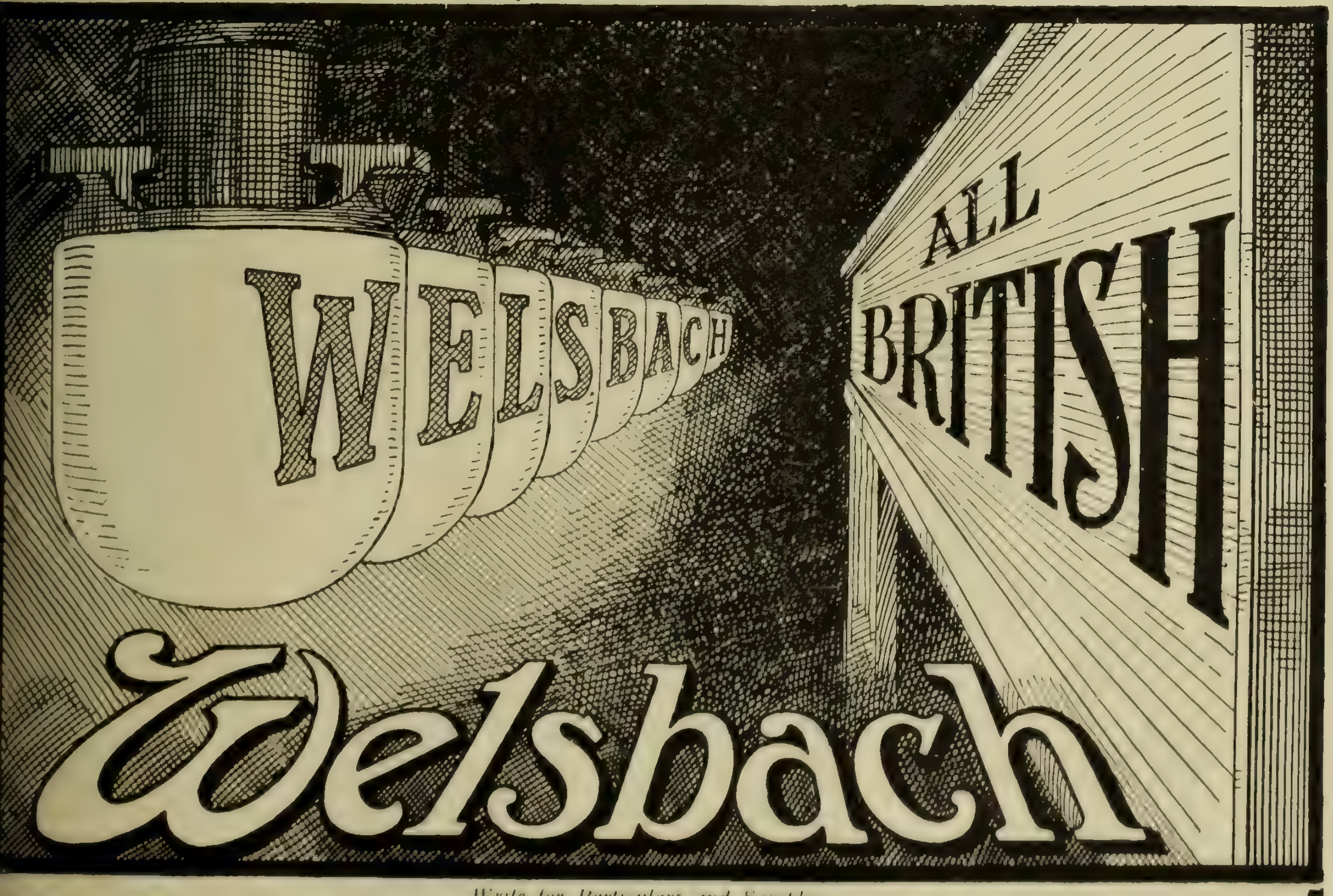
The Highways Committee of the Southend-on-Sea Town Council have again had under consideration the accounts of the Gas Company for street lighting for the Michaelmas quarter. The Secretary of the Company attended before the Committee to deal with the charges made during the continuance of the reduced lighting. The Committee were reminded that the original principle adopted was that a deduction should be made from the ordinary quarterly account equal to the actual value of the gas unconsumed; so that when all the gas-lamps were extinguished, only the standing charges incidental to their installation and maintenance would be charged. The Committee were also reminded that the Company had made a further allowance at the rate of 2s. per lamp per annum, in view of the saving effected in mantles during the total discontinuance of the lighting. After the matter had been discussed, the Company agreed to make a further allowance of 1s. 6d. per lamp per annum from the amount of the standing charges, thus effecting another reduction in the account of about £112 per annum. With reference to the lighting of the Leigh area of the town, the Surveyor reported at a later meeting that the Gas Committee were prepared to reduce their charges to the same extent as had been arranged in regard to the accounts of the Southend Gas Company. In view, however, of the higher cost of gas in the Leigh area, the Surveyor was directed to bring the matter again before the Gas Committee for consideration.

* * *

Price of Gas at Brisbane.—A Bill to deal with the price and quality of gas at Brisbane is to be introduced at an early date. The measure will, it is said, be far-reaching, and will have the effect of largely reducing the price of gas.

Increase in Price at Bingley.—On the recommendation of the Gas Committee it was last week decided by the Bingley Urban District Council that the price of gas should be increased 6d. per 1000 cubic feet. In answer to a question, the Chairman (Mr. H. Laycock) stated that the increase was no greater than was required to meet the extra cost of coal and labour, and it was really very doubtful whether it would altogether cover the higher cost.

Budleigh Salterton Public Lighting.—At a meeting last Tuesday of the Budleigh Salterton Urban District Council, the Public Lighting Sub-Committee reported having met representatives of the Gas Company, when the questions at issue between the Council and the Company were fully discussed. The Sub-Committee intimated that the Council were not prepared to increase the offer made by them to pay 10s. per lamp for the year to March 31 last. Dr. Perkins, on behalf of the Gas Company, stated that they could not accept such an offer, but intimated that if it was increased to £1 1s. per lamp it would be accepted. In this deadlock the Clerk was instructed to prepare a case for Counsel, but later the parties compromised with 12s. 6d. per lamp; and a resolution was passed accordingly.



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AND AT BIRMINGHAM, MANCHESTER, LEEDS, STOKE-ON-TRENT, HULL, BRISTOL, AND DUBLIN.

Welsbach Mantles are Upright (C, CX, and Plaissetty) and Inverted.

The Filey Council have decided not to appoint a gas engineer for the present in succession to Mr. Henry Tobey, the Manager of the Malton Gas-Works, who recently resigned his position as Supervising Engineer at Filey. The Council are to call in advice as necessary.

Acknowledgment has to be made of the receipt of a serviceable pocket case and diary from the Gas-Meter Company, Limited, Kingsland Road; and a case for Treasury notes from Messrs. Pinchbeck, Limited. There has also come to hand the Co-Partnership Almanac of the South Metropolitan Gas Company, which on this occasion includes a Roll of Honour, in addition to a portrait of the late Sir George Livesey, with the words beneath it "Co-partnership is Brotherhood in Business," as well as the following Directors' message: "Another twelve months of war have passed and left unweakened the bonds of a co-partnership which has long flourished among the employees of this Company. All are sharing cheerfully the burden of increased strain and anxiety thrown upon them by the response of so many of their companions to the country's call. They are maintaining magnificently the war fund, voluntarily created by their contributions, to provide for the families and dependants left behind. In bearing this testimony to the crowning glory of co-partnership, the Directors earnestly hope victory may justify relaxation of these efforts in the New Year."

APPLICATIONS FOR LETTERS PATENT.

17,415.—Bell, R., "Art of gas lighting and burners therefor." Dec. 13.

17,493.—Williamson Cliff, Ltd., and Cliff, A., "Manufacture of refractory articles." Dec. 14.

17,543.—Harvey, E. W., "Regenerative gas-furnaces" Dec. 15.

17,560.—Lanston Monotype Corporation, Ltd., "Burners for melting-pots." A communication from the Lanston Monotype Machine Company. Dec. 15.

17,620.—Humphrey, H. A, and Rusdell, W. J., "Inlet and exhaust in internal combustion engines." Dec. 16.

17,621.—Humphrey, H. A., and Rusdell, W. J., "Pump for liquids." Dec. 16.

17,622.—Humphrey, H. A, and Rusdell, W. J., "Valves for pumps for liquids." Dec. 16.

17,628.—Chaney, W., and Boughton, H. F., "Gas manufacture." Dec. 17.

17,670.—Ionides, A. C., jun., "Proportioning gaseous mixtures." Dec. 17.

STOCK MARKET REPORT.

The paucity of business on the Stock Exchange was illustrated last week by the closing of the House after the termination of Thursday's operations until after the Christmas holiday. This, perhaps, was in some measure a result of the upset caused in the preceding week by the invasion of the French Loan and the Exchequer Bond issue. So the markets had a quiet four-day period, and one that was not without its good points. A favourable feature was the firmness of Home Government issues and other constituents of the gilt-edged division. The War Loan and Consols steadily acquired strength, and Colonial issues were in demand. The American Market was firmer; and Canadian Pacific reflected the bright prospect afforded by a splendid harvest and big traffic returns. South Africans consolidated their good position. In the Foreign Market, the French Loan and Japanese issues continued to find favour. In the Miscellaneous Group, Rubber improved its outlook, and armaments and other warlike appliances were in request. Home Rails did not succeed in keeping step with the rest; but they made a little better show before the close. So that, taken all round, prices advanced, and the week terminated cheerfully. As regards the internal affairs of the House, one or two matters were much in evidence. Great soreness has been felt by members that some restrictions imposed upon them—*e.g.*, as to minimum prices—should be allowed to be bye-passed by outsiders. It is hoped that action taken by the Committee will remove this disadvantage. In regard to the exclusion of members of Teutonic birth, the resolution passed by the Committee is thought by many not to go far enough. Widespread irritation is felt at the Stock Exchange being ignored by the Treasury and not consulted in relation to various points of national finance, in which they could afford expert advice. Another source of friction—as to commission upon the American securities acquired by the Treasury through the agency of members—is being dealt with. Business in the Gas Market was quite quiet and devoid of feature. Prices may be quoted generally as unchanged. In the Money Market, the supply met all demands for short loans with ease, but discount rates hardened.

Bargains done for cash during the week were as follows: On Monday, European 12½, Gas Light ordinary 72, 72½, Primitiva preference 3 9/16, 3⅝, 3 21/32, 3 11/16, South Metropolitan 79½. On Tuesday, Commercial 4 per cent. 81, European 12 11/16, Gas Light ordinary 72, 72⅜ 72½, Primitiva preference 3 9/16, River Plate 72, South Metropolitan 79. On Wednesday, European 12 11/16, Gas Light ordinary 71¾, 72, Melbourne 96¾, South Metropolitan 79½, Wandsworth "B" 100. On Thursday, Commercial 4 per cent. 78, European 12 11/16, Gas Light ordinary, 71, 71⅛, 71½, South Metropolitan 78½.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

Lance-Corporal Richard Rossall, of whom his parents at Pudsey have recently learned that he has been awarded the Distinguished Conduct Medal, was, prior to enlisting for the war, a stoker at the Pudsey Corporation Gas-Works. He received the award, and also his promotion, for bravery in action at Hooge.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	..
874,000	"	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water 10 p.c.	29—30	5 6 8	..
873,480	10	"	7	7/-	Bournemouth Gas and Water B 7 p.c.	15—15½	4 10 4	..
95,000	10	"	6	6/-	Bournemouth Gas and Water Pref. 6 p.c.	13½—14	4 5 9	..
147,210	—	—	—	4	Bournemouth Gas and Water Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3	..
830,000	"	"	†11	55/-	Do. New	204—209	5 5 3	..
50,000	"	"	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	"	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10¾	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	"	"	8	7¾	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb.Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	78—81
560,000	"	"	5⅛	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	"	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	"	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	"	"	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	"	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	12½—12 11/16
16,362,910	Stk	Feb. 12	4/17/4	42/-	Gas Light and Coke 4 p.c. Ord.	98—102	4 15 6	71—72½
2,600,000	"	"	3½	3½	Gas Light and Coke 3½ p.c. max.	76—79	4 8 7	..
4,062,235	"	"	4	4	Gas Light and Coke 4 p.c. Con. Pref.	96—99	4 0 10	..
4,674,850	"	June 11	3	3	Gas Light and Coke 3 p.c. Con. Deb.	72½—74½	4 0 6	..
130,000	"	"	10	10	Gas Light and Coke 10 p.c. Bonds	..	—	..
258,740	Stk	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅞	7¾	Ilford A and C	151—154	5 2 4	..
65,780	"	"	6⅜	6¼	Do. B	115—118	5 8 0	..
65,500	"	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk	May 14	9	4½	Imperial Continental	150—160	5 12 6	..
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	"	"	7		Liverpool 5 p.c. Ord. B	146—148	4 14 7	
306,083	"	June 26	4	4	Do. 4 p.c. Pr. Deb.Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	96¾
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4¼	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅖	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7¼—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 3	..
100,000	50	"	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	"	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 13 4	..
499,960	5	June 26	5	2/6	" 5 p.c. Pref.	4¾—5	5 0 0	3 9/16—3 11/16
521,600	100	June 2	4	4	" 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	" " " 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	72
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	"	"	10	10	Do. B	222—224	4 9 3	..
523,500	"	"	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	78½—79½
1,895,445	"	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	"	"	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
137,058	"	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	.
120,000	Stk.	Feb. 12	7½	7½	Tottenham District A 5 p.c.	136—138	5 8 8	..
742,275	"	"	6	6	Tottenham District B 3½ p.c.	115—117	5 2 7	..
181,255	"	June 26	4	4	Tottenham District 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	"	"	6⅞	63/9	" B 3½ p.c.	129—134	5 2 7	100
108,075	"	"	5/17/3	55/1½	" C 3½ p.c.	110—115	5 2 0	..
352,000	"	"	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	"	"	6⅝	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	"	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

The Stockton-on-Tees Chemical Works has been registered with capital of £10,000 in £1 shares. The address of the Company is arkfield Works, Stockton-on-Tees. The registration is as a "private" ompany. The first Directors are Mr. E. Lloyd Pease and Mr. W. eswick (representing the Power Gas Corporation), and Mr. A. F. ease (representing Messrs. Pease and Partners).

The "Mechanical World" Electrical Pocket-Book for 1916 (which published by Messrs. Emmott and Co., Limited, of No. 65, King treet, Manchester, at the price of 6d. net) contains, as usual, a large mount of useful information on a variety of subjects connected with ie electrical industry. Among the new features, a prominent place is aken by the lengthy section on switch gears and switch boards. The ections on electric lamps and electric lighting have been brought up date, and the book generally has been thoroughly revised.

The covers of three electric light street-boxes were blown off by explosions in Rotherhithe Street last week; the occurrence being attributed to defective electric circuits. One of the firemen attending received a shock, and was taken to the hospital, but not detained.

At the last meeting of the Bradford Gas Committee, when the question of advancing the price of gas from 2s. 6d. to 2s. 9d. per 1000 cubic feet was deferred until May, it was mentioned that there were private companies with a smaller production who charged less for gas than the Bradford present charge.

Tenders are invited (on conditions which will be found notified in our advertisement columns to-day) for £20,000 of "D" ordinary 7 per cent. stock in the Colne Valley Water Company. The minimum price fixed is £125 per cent., at which, it is pointed out, the yield to the investor will be £5 12s. per cent. per annum.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

SUPERINTENDENT. Portsea Island Gas Company. Applications by Jan. 1.
MANAGER. Louth Gas Company. Applications by Jan. 5.
DRAUGHTSMAN. Bale and Hardy, 39, Victoria Street, S.W.
MECHANICS. No 6128.
SALESMAN. Rochdale Gas Department. Applications by Jan. 5.
WORKING FOREMAN. Holbeach Gas Company.

Appointments, &c., Wanted.

SHOW-ROOM MANAGER. A. C. Portbury, Rochdale.

Plant, &c. (Second Hand), Wanted.

PURIFIERS. No. 6129.

Sales of Stocks and Shares.

COLNE VALLEY WATER COMPANY. By tender. Jan. 11.
HAYWARDS HEATH GAS COMPANY. By tender. Jan. 14.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated ly the name and address of the writer—not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1916 are reminded that this can only be done before the end of January.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

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D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS.
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Telegrams: "DACOLIGHT LONDON."
Telephone: 2336 HOLBORN.

MEWBURN, ELLIS, AND PRYOR.
CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70, Chancery Lane, London.
Telegrams: "Patent London." 'Phone: 243 Holborn.
And 8, St. Nicholas Buildings, Newcastle-on-Tyne.

ALDER AND MACKAY
ESTABLISHED 1850).
WET AND DRY METERS.
SLOT AND ORDINARY.
STREET LAMPS AND AUTOMATIC CONTROLLERS.
EDINBURGH.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, London, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
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SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—
BALE AND HARDY,
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SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.,
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Telegrams: "HYDROCHLORIC, FEN. LONDON."
Telephone: 1588 AVENUE (3 lines).

SPENCER'S PATENT HURDLE GRIDS.
THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Nov. 16, p. 354.

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FOR Gas-Works Plant of Every Description; also SULPHATE OF AMMONIA and SULPHUR RECOVERY PLANTS.
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Tins for sale to Consumers.
In Bulk for Works Use.
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JAMES MILNE AND SON, LIMITED.

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FALCON WORKS, BARNSLEY.
MANUFACTURERS OF
GAS METERS (Ordinary and Prepayment),
"FALCON" INVERTED LAMPS and SQUARE LANTERNS for Street Lighting,
INVERTED BURNERS and CONVERSION SETS for Street Lamps.

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(Powder or Paste).
For Gas Retort and Furnace Repairs, &c.
(42nd Year of Sale).
Prices and Samples free on Application.
THE "PLUTONIC" CEMENT COMPANY,
Telegrams: "PLUTONIC, BIRMINGHAM."
62, BISSELL STREET, BIRMINGHAM.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
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Telegrams: "SATURATORS BOLTON." Telephone 0848.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every Description of GAS APPARATUS, ELEVATING, CONVEYING, and TELPHERAGE PLANTS, also STOKING MACHINERY, Rose Mount Ironworks, Elland.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.

It is also used for the Enrichment of Gas.

Manufactured and Supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agents, F. J. Nicol & Co., Pilgrim House, Newcastle-on-Tyne.

Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

TAR WANTED.

THE Burnden Tar Company (Boltòn), Ld.
Hulton Chemical Works, BOLTON.

J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

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COMPLETE CARBONIZING PLANTS,
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Prices and Designs on Application to
THE IRONWORKS, FROME, or
London Office: 39, Victoria St., Westminster S.W

JOHN RILEY & SONS, Limited, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 years. References given to Gas Companies.

GAS Show-Rooms—Situation required as MANAGER. Well up in Cooking, Heating, Lighting, and Hot-Water Apparatus. Keen buyer. Good Organizer. Excellent Testimonials.

Address A. C. Portbury, Corporation Gas Show-Rooms, Rochdale.

WANTED—A Practical Manager for Company making 50,000,000 cubic feet. Applicants must be used to Regenerative Settings, Sulphate Plant, and Outside Management, and be Ineligible for Military Service. House, Coal, and Gas found.

Applications. in writing, stating Age, Experience, and Salary required, accompanied by not less than two Testimonials, to be sent by the 5th of January next to Mr. Philip Allison, Secretary, Gaslight Company, Louth, Lincs.

Louth, Dec. 13, 1915.

WANTED—at once, a Working FOREMAN (not eligible for Military Service) for small Gas-Works carbonizing about 700 Tons of Coal Yearly.

Applicants must state Age, Wages required (good House, Garden, Coals, and Gas found), and send in their References to Thos. C. Willders, Secretary, Gas Company, Holbeach.

Holbeach, Dec. 23, 1915.

EXPERIENCED Draughtsman Wanted in London. Thorough Knowledge of Bye-Product Coking Plant essential.

Apply, stating Age, Salary required, and all Particulars, to Bale and Hardy, 39, Victoria Street, London, S.W.

PORTSEA ISLAND GASLIGHT COMPANY.

FLATHOUSE WORKS.

APPLICATIONS are invited for the Position of SUPERINTENDENT for the above Works, where the daily make of Gas is from 3,000,000 to 4,000,000 cubic feet.

Candidates must have a Thorough Practical Knowledge of Carbonization in both Horizontal and Vertical Retorts, and have had a Good Technical Training, together with the Management of a large Works in all its Branches.

Commencing Salary, £250 per Annum, with House and Rates (only) free.

Applications, stating Age, previous Experience, whether Married or Single, accompanied by *copies* of not more than Three Testimonials of recent date, and endorsed "Superintendent," must be sent to me not later than the 1st of January, 1916.

J. D. Ashworth,
Engineer and General Manager.
Engineer and General Manager's Office,
Hilsea Gas-Works, Cosham, Hants.

WANTED—Two Good Mechanics for Suburban Gas-Works used to Gas and Steam Engines, Pumps, &c., and Lathes and Machines in Machine Shop. Wages according to Ability *plus* 5s. War Bonus.

Must be Ineligible for Military Service.

Apply, by letter, with Particulars of Experience, to No. 6128, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

BOROUGH OF ROCHDALE.
(Gas Department.)

THE Gas and Electricity Committee of the above Corporation invite Applications for the Position of SALESMAN in the Gas Department Show-Rooms in Drake Street.

Applicants must have had previous Experience in a similar capacity and be Ineligible for Military Service.

Salary, Two Guineas per Week.

Applications, in Candidates' own Hand-Writing and accompanied by not more than Three recent Testimonials, must be addressed to the Chairman of the Gas and Electricity Committee, Gas-Works, Rochdale, and Delivered before noon on Wednesday, Jan. 5, 1916.

By order,
Wm. Henry Hickson,
Town Clerk.
Town Hall, Rochdale,
Dec. 22, 1915.

WANTED—Good, Clean, and Hard CARBON, in Four-Ton Lots, or more, f.o.r.

Address, No. 6072, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED—One or Two Second-Hand PURIFIERS about 24 feet Square. Must be in Good Condition.

Particulars and Prices to No. 6129, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

TANKS for Sale—
One BOILER TANK, 6 ft. 6 in. diam. by 20 ft. long, £60.
One Dished-End AIR RECEIVER, 4 ft. 3 in. by 9 ft. 8 in., £25.
Two BOILER TANKS, 8 ft. 6 in. diam. by 20 ft. long, £75 each.
Two Oval BOILER TANKS, 8 ft. 6 in. deep by 6 ft. wide by 20 ft. long, £70 each.
One Egg-End BOILER TANK, 8 ft. diam. by 20 ft. long, £60.
One CAST-IRON TANK, in plates, 18 ft. by 12 ft. by 5 ft. deep. £75.
One CAST-IRON TANK, in plates, 14 ft. by 8 ft. by 4 ft. deep, £45.
One CAST-IRON TANK, in plates, 14 ft. by 7 ft. by 2 ft. deep, £30.

All Clean, Good Order, and Satisfactory in every way. Several other Sizes in Stock; also PUMPS, ENGINES, BLOWERS, EXHAUSTERS, GIRDERS, &c., &c. Inquiries Solicited, and prompt Attention Guaranteed.

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ONE First-Class Lancashire Boiler 6 ft. 6 in. diam. by 15 ft. long. Insured for a Working Pressure of 120 lbs., with all Fittings Complete. Price £220.

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PATENTS.—Handbook of Patent Law, by W. P. Thompson, F.C.S., M.I.Mech.E., C.P.A., International Patent Agent, 6, Lord Street, Liverpool, and Bradford and London. 16th Edition 1915, 242 pages. 2s. 6d. Post free. English Portion, 6d. "A useful guide to inventors. The subject is treated in a simple and concise manner."—Journal of Gas Lighting.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given that the TRANSFER BOOKS of this Company, SO FAR AS THEY RELATE TO CAPITAL STOCKS, WILL BE CLOSED at Four o'clock p.m. on Tuesday, the 4th day of January next, and WILL BE RE-OPENED immediately after the Half-Yearly Ordinary General Meeting of the Company, to be held on Friday, the 4th day of February next.

By order,
Henry Rayner,
Secretary.
Chief Office: Horseferry Road,
Westminster, S.W., Dec. 22, 1915.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 37, Walbrook, E.C.

By order of the Directors of the
HAYWARDS HEATH DISTRICT GAS COMPANY.

MESSRS. A. & W. RICHARDS have RECEIVED INSTRUCTIONS TO OFFER FOR SALE BY TENDER

£3500 FIVE PER CENT. PERPETUAL DEBENTURE STOCK

at the Minimum price of Par, and

£5000 ORDINARY STOCK

also at the Minimum price of Par, in the above Undertaking.

The Ordinary Stock is entitled equally with the Company's existing similar Stock to a Dividend of £6 2s. 6d. per Cent. per Annum.

Tenders will be opened on Friday, Jan. 14, 1916.

Particulars and Forms of Tender may be obtained at the Company's Offices at Haywards Heath and 85, Gresham Street, E.C., and of Messrs. A. & W. Richards, Auctioneers, 37, Walbrook, E.C.

COLNE VALLEY WATER COMPANY.

NEW ISSUE OF £20 000 "D" ORDINARY 7 PER CENT. STOCK.
Minimum Price, £125 per £100 of Stock.
Yielding at this Price £5 12s. 0d. per Cent. per Annum.

TENDERS are invited for the above Stock, which ranks for dividend up to 7 per cent. equally with all classes of existing Ordinary Stock. Maximum Dividends have been paid by the Company for many years.

Tenders to be sent in on or before 10 a.m. on Tuesday, the 11th of January, 1916.

Forms and full Particulars to be obtained from the Secretary of the Company at their Head Offices, Bushey, Watford; from the London County and Westminster Bank, London and Watford; or of the Company's Brokers, Messrs. Sheppards, Pelly, Price, and Pott, 57, Old Broad Street, London, E.C.

By order of the Directors,
C. P. Sinclair,
Secretary and General Manager.

His Majesty's Treasury requires the following note to be appended:—

The Treasury has been consulted under the Notification of the 18th of January, 1915, and raises no objection to this issue. It must be distinctly understood that in considering whether they have or have not any objections to new issues the Treasury does not take any responsibility for the financial soundness of any schemes or for the correctness of any of the statements made or opinions expressed with regard to them.

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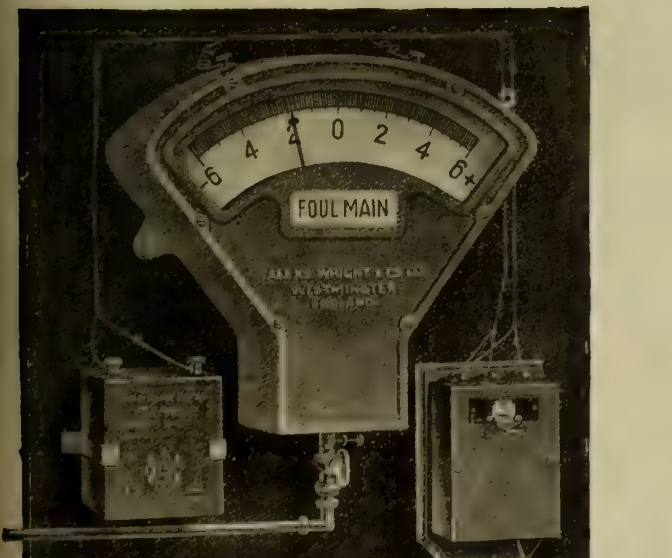

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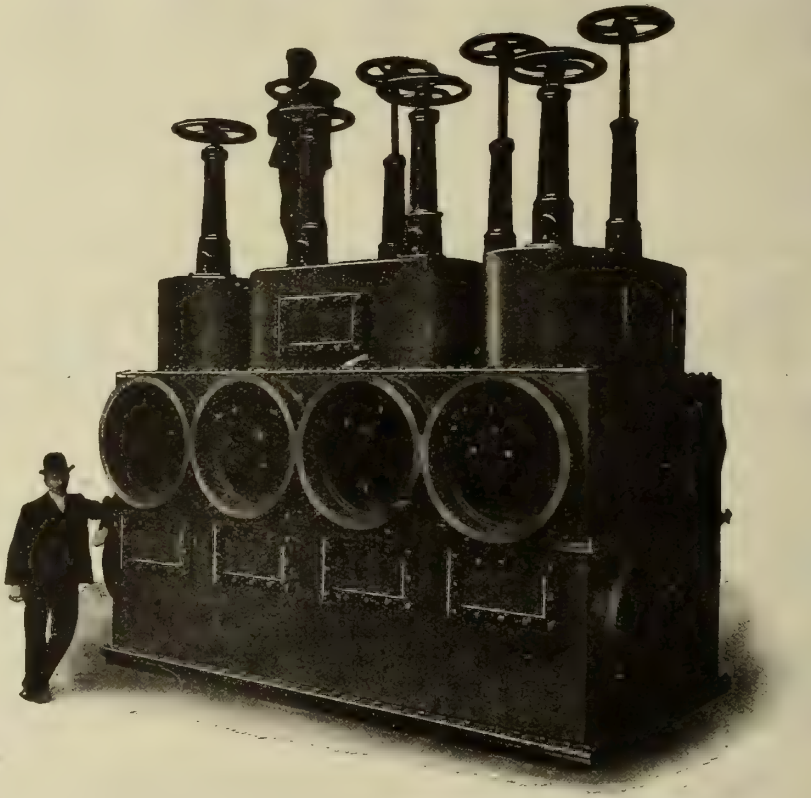

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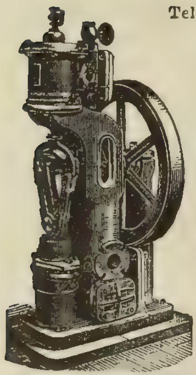

Fig. 705. "SINGLE RAM" STEAM-PUMP.

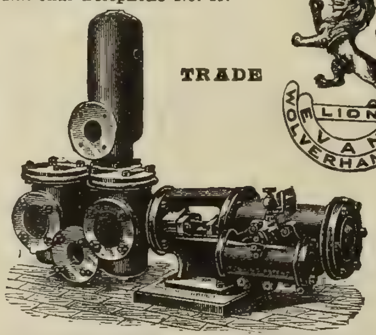

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

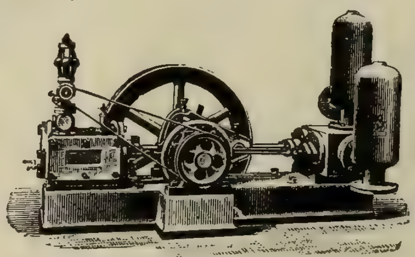

Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

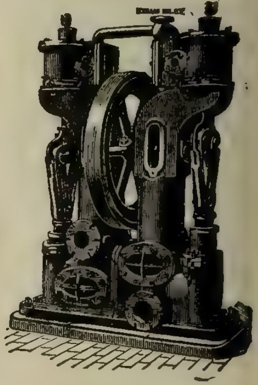

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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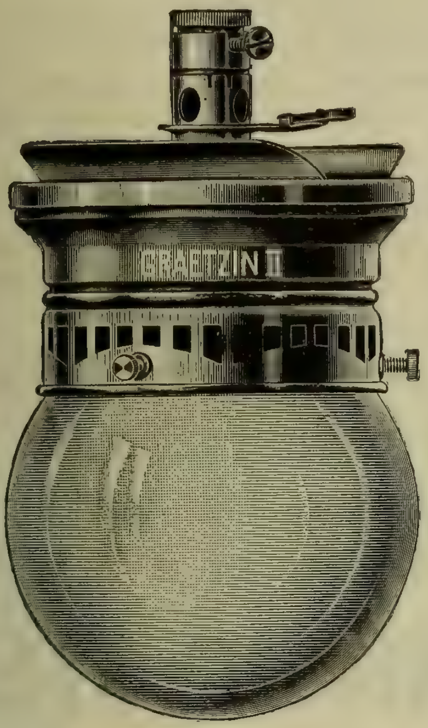

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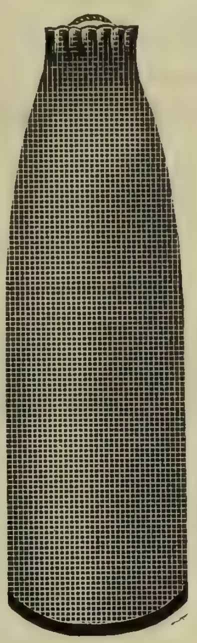

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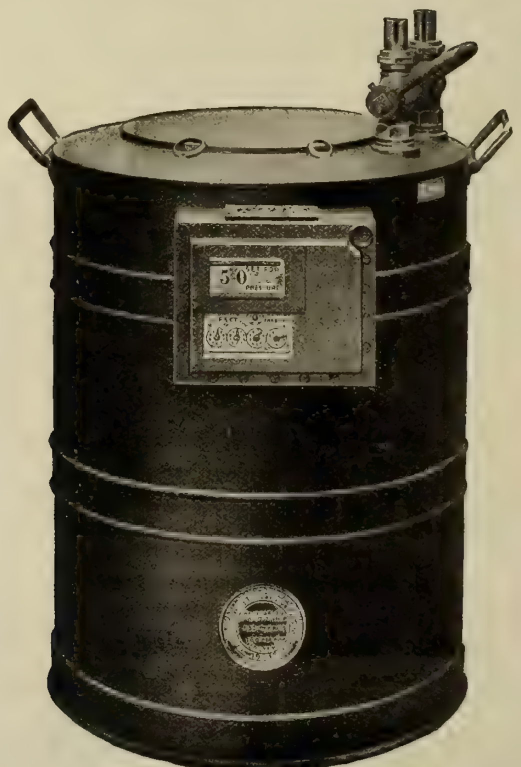

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N. Middlesex (3)	75,000
N. Middlesex (4)	650,000
N. Middlesex (5)	650,000
North Sydney	500,000
North Sydney (2)	500,000
Norwich	1,000,000
Norwich (2)	300,000
Norwich (3)	500,000
Nottingham	1,000,000
Nottingham (2)	1,000,000
Nuneaton	125,000
Oberhausen	175,000
Oldenburg	200,000
Ostend	100,000
Ostend (2)	200,000
" Zandvoorde.	700,000
Pembroke	240,000
Perth, W.A.	125,000
Pontypool	120,000
Poole	1,500,000
Poole (2)	1,000,000
Port Elizabeth	400,000
Portsmouth	1,000,000
Portsmouth (2)	2,000,000
Posen	450,000
Posen (2)	700,000
Prague	140,000
Preston	1,400,000
Reading	1,000,000
Reading (2)	1,000,000
Redditch	500,000
Redhill	275,000
Redhill (2)	300,000
Reichenberg	200,000
Reichenberg (2)	200,000
Reval	350,000
Rhymney	175,000
Rhymney (2)	250,000
Ripley	120,000
Romford	300,000
Romford (2)	350,000
Rotterdam	850,000
Rotterdam (2)	1,500,000
Rotterdam (3)	750,000
Rotterdam (4)	750,000
Rotterdam (5)	600,000
Rotterdam (6)	2,000,000
Rugby	1,000,000
Rushden	425,000
St. Albans	700,000
St. Gallen	225,000
St. Gallen (2)	225,000
St. Joseph	750,000
San Paulo	700,000
Santiago, Cuba	400,000

	Cubic Feet Daily
Scarborough	800,000
Scarborough (2)	200,000
Scarborough (3)	350,000
Shanghai	225,000
Shanghai (2)	225,000
Shanghai (3)	1,600,000
Sheerness	200,000
Southall	2,000,000
Southampton	800,000
Southampton (2)	500,000
Southampton (3)	600,000
Southampton (4)	100,000
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Southgate (2)	500,000
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Southport (2)	900,000
South Shields	650,000
Stafford	500,000
Staines	600,000
Stettin	880,000
Stockholm	1,500,000
Stockholm (2)	1,750,000
Stockport	600,000
Stockport (2)	600,000
Stockport (3)	400,000
Stockport (4)	400,000
Stockton	500,000
Stockton (2)	250,000
Stourbridge	500,000
Stourbridge (2)	500,000
Swansea	750,000
Swansea (2)	1,000,000
Swansea (3)	450,000
Swindon	300,000
Swindon (2)	450,000
Sydney	1,000,000
Sydney (2)	1,000,000
Sydney (3)	1,000,000
Sydney (4)	1,000,000
Syracuse, N.Y.	850,000
Taunton	225,000
Taunton (2)	350,000
The Hague	1,000,000
The Hague (2)	500,000
The Hague (3)	1,750,000
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Tirlemont	120,000
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Torquay (2)	350,000
Tottenham	750,000
Tottenham (2)	750,000
Tottenham (3)	350,000
Tottenham (4)	1,000,000
Tottenham (5)	1,000,000
Tottenham (6)	1,250,000
Tottenham (7)	2,500,000
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Utrecht	1,000,000
Utrecht (2)	1,000,000
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Vienna	3,500,000
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Crosfield & Sons	1,500,000
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Wasmuel	500,000
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Weimar	100,000
Wellington, N.Z.	350,000
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West Ham	1 500,000
West Ham (2)	800,000
Weston-Mare	350,000
Weston-Mare (2)	350,000
Wexford	100,000
Wiesbaden	850,000
Winchester	225,000
Winchester (2)	125,000
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CONTENTS.

EDITORIAL NOTES.

915—A Retrospect 679
Ir. Jones on the Origin of the Sliding-Scale —French Gas Consumers and Toluol Extraction 696
Question in Parliament—Gas in Train Accidents—Sulphate of Ammonia Exports —Patents in Enemy Countries—Forthcoming Trade Exhibitions 697

---

he Late Professor Lewes 698
lectricity Supply Memoranda 698
he "JOURNAL" and the Origin of the Sliding-Scale. 700
resentation to Mr. Norton H. Humphrys . 700
he South Metropolitan Company's Investigation into the Evaporation of Naphthalene in Air and Coal Gas Vapours 701
rench Arrangements for the Extraction of Toluol 703
ome Reflections on Unaccounted-For Gas . 704
ecovering Ammonia from Waste Liquor . 704
ower Plant in Factories. 705
easuring a Venturi Tube Discharge through a Direct-Reading Meter 706
ar Oils of Various Grades in Relation to the Production of Commercially Important Dyes 707
mportance of Flues in the Fixing of Gas-Fires. By H. H. Creasey 707

CORRESPONDENCE.

The Origin of the Sliding-Scale 709
Exports of Sulphate of Ammonia 709
Concerning Naphthalene Troubles . . . 709
Gas-Fires and Electric Radiators 710

REGISTER OF PATENTS.

Rotary Blowers and Gas Compressors—Güttner, M. 710
Controllers for Gas-Fires—Grafton, W. . . 710
Lamp for Gas under Pressure with Previously Heated Primary Air Supply—Ehrich and Graetz 711
Breaking-Down Clinker in Gas-Furnaces—Gill, G. M., Donald, D. B., and Jenkinson, W. 711
Applications for Letters Patent 724

MISCELLANEOUS NEWS.

South Metropolitan Company's Capital Powers 712
Imperial Continental Gas Association Bill . 712
Co-Partnership and the Future 713
British Coalite Company, Limited 713
Colonial Gas Association, Limited 714
Factory and Workshop Lighting 714
The Dutch Bureau of Coals 716
The Del Monte Process 716
Gas Supply Troubles at Ripon 716
Local Authorities and the Toluol Question . 716
Exports of Sulphate of Ammonia 717
Effect of Gas upon Organs 718
Jarrow Railway Accident. 720
Current Sales of Gas Products 721
Coal Trade Report. 722
Stock Market Report 724

PARLIAMENTARY INTELLIGENCE.

Privately-Owned Railway Waggons; Price and Quality of Gas; British Gas Undertakings in Germany. 711

LEGAL INTELLIGENCE.

United Gas-Works Development Company . 712
A Disputed Sulphate of Ammonia Contract . 712
Claim by an Engineer of the Garden City . 712

PARAGRAPHS.

Scottish Junior (Western) Gas Association—The Employment of Maimed Discharged Soldiers by Gas Undertakings 698
Chains and other Lifting Appliances—Illuminating Engineering Society—Underground Waters in Australia. 704
Gas for a Rust-Proofing Process—Illuminating Engineering Society 708
Loan Question at Stratford-on-Avon . . . 712
Neath Labour Dispute Ended 713
Fatality to a Gas-Fitter 715
Fatality at the Dudley Gas-Works—Humphrey Pump Company—Bilston Gas Company 718
Sale of Shares — Lighting of Athens — European Gas Company—Lighting Matters at Hendon—Maximum Coke Prices. . . . 722
Sedgley Gas-Works Results—Accident at a Birmingham Gas-Works—Wages at Rochdale—Public Lighting at Southend—Price of Gas at Brisbane—Increase in Price at Bingley—Budleigh Salterton Public Lighting 723
Filey Gas Engineership 724

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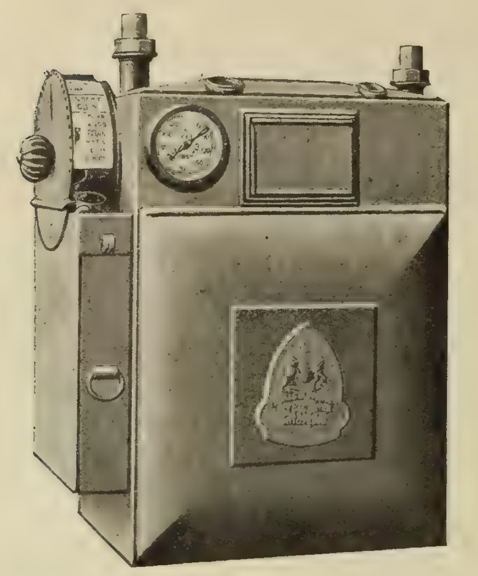

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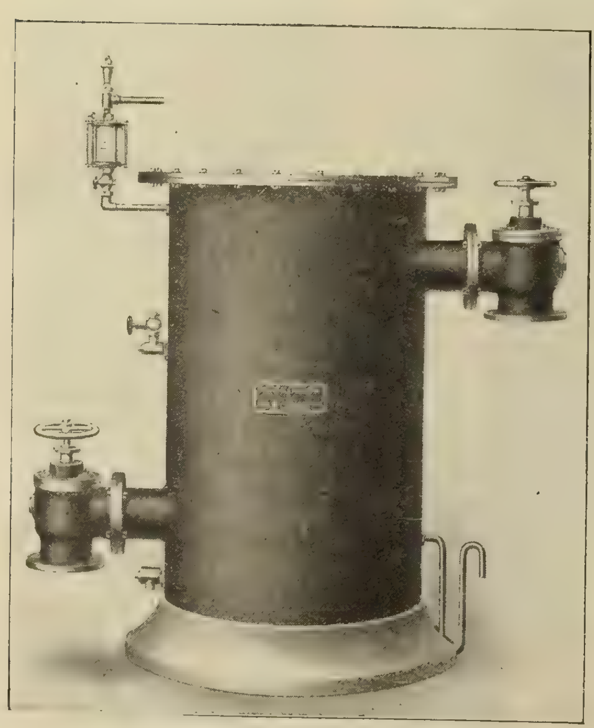

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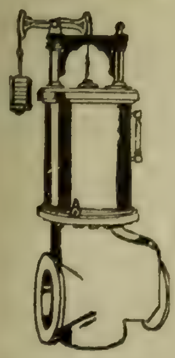

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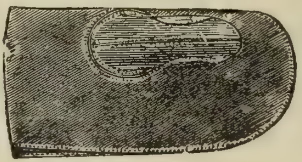

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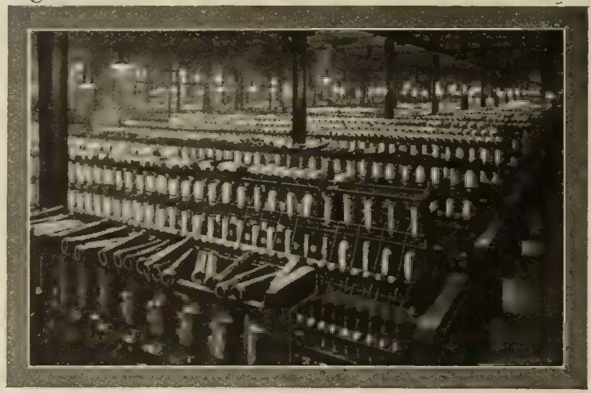

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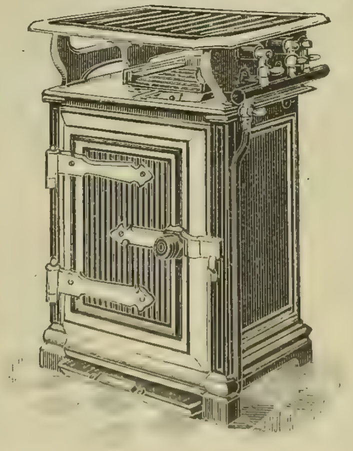

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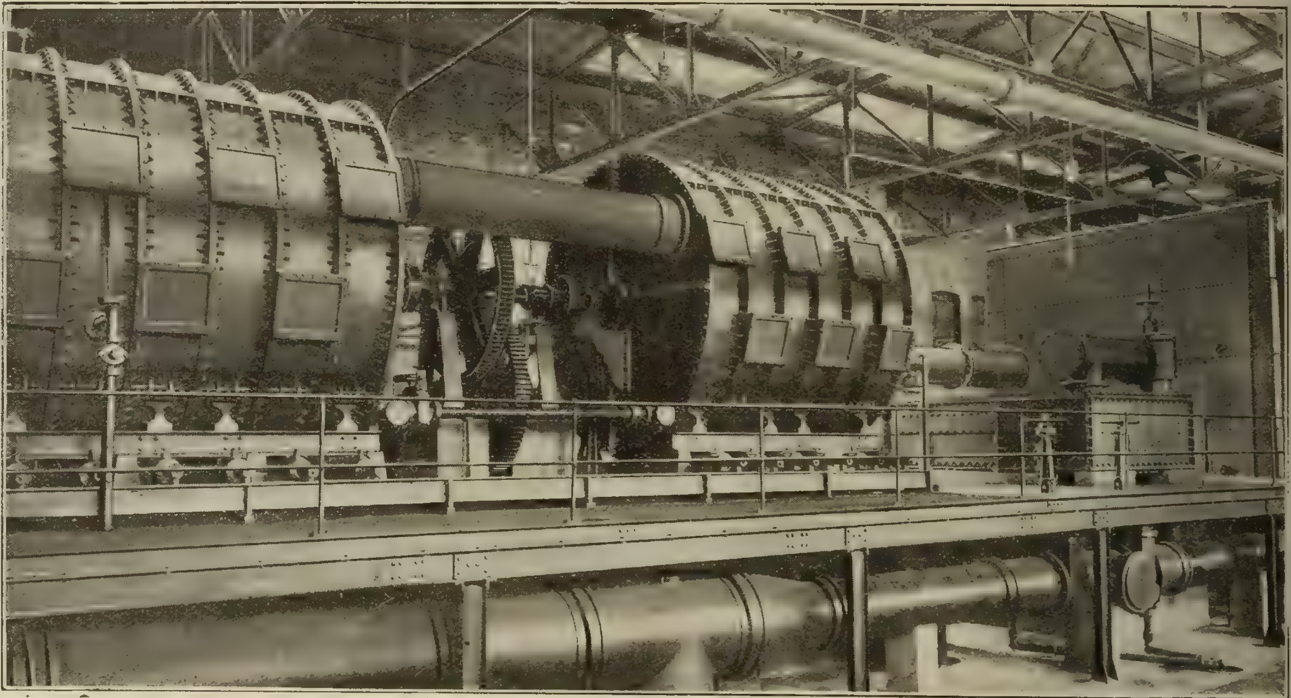

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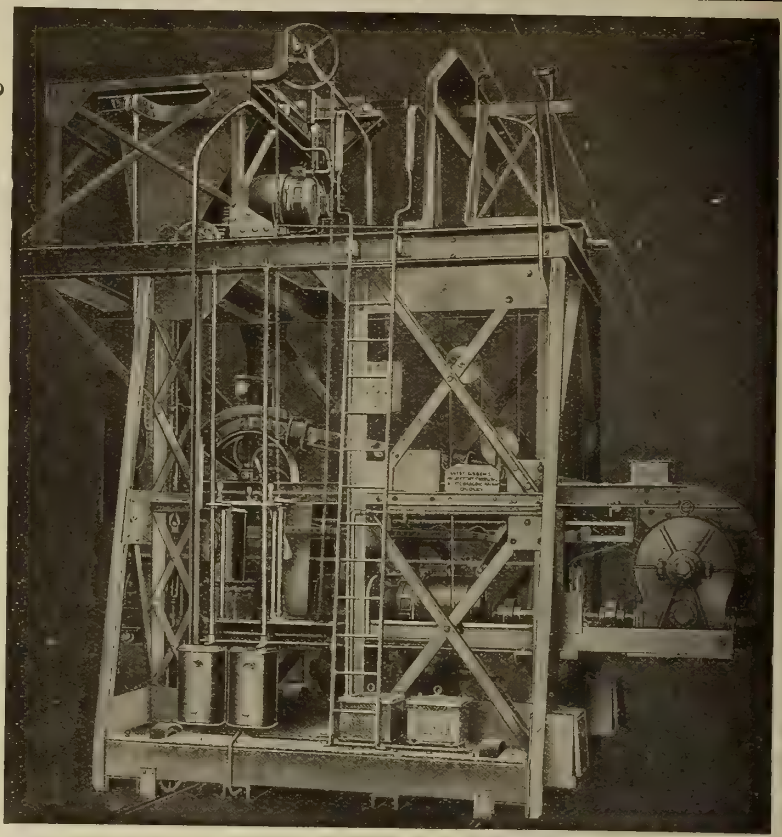

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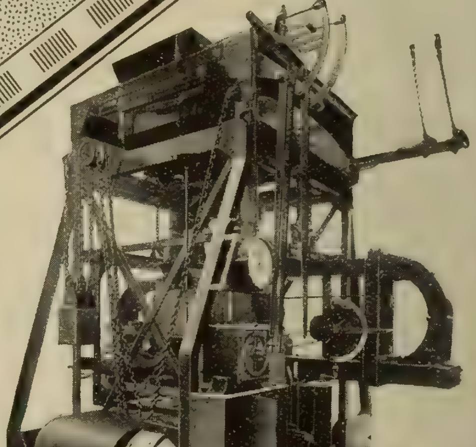

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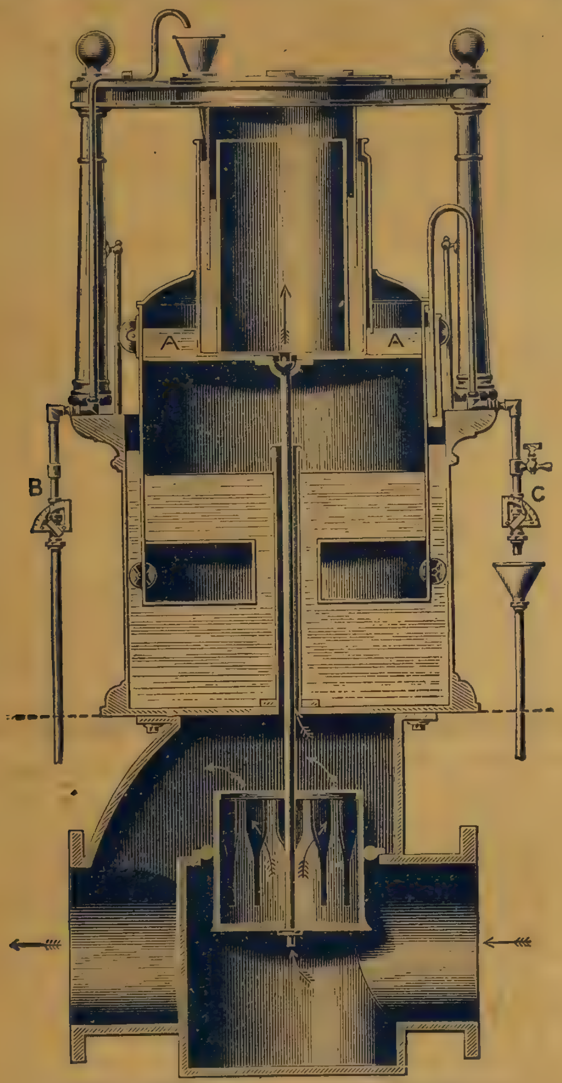

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9

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